PETITION TO LIST
THE QUINO CHECKERSPOT BUTTERFLY (*Euphydryas editha quino*)
AS ENDANGERED UNDER
THE CALIFORNIA ENDANGERED SPECIES ACT

Photo credit: Robert A. Hamilton, Hamilton Biological

CENTER FOR BIOLOGICAL DIVERSITY
And
ENDANGERED HABITATS LEAGUE

June 29, 2020

FGC – 670.1 (3/94)

**NOTICE OF PETITION TO THE STATE OF CALIFORNIA
FISH AND GAME COMISSION**

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED
Common name: Quino checkerspot butterfly
Scientific name: (*Euphydryas editha quino*)

II. **RECOMMENDED ACTION:** List as endangered

The Center for Biological Diversity and Endangered Habitats League submit this petition to list the Quino checkerspot butterfly as endangered throughout its range in California pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 *et seq*.). This petition demonstrates that the Quino checkerspot butterfly clearly warrants listing based on the factors specified in the statute.

III. AUTHOR OF PETITION
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I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: Tara Cornelisse Date: June 29, 2020

The **Center *for* Biological Diversity** is a national, nonprofit conservation organization with more than 1.6 million members and online activists dedicated to the protection of endangered species and wild places.

The **Endangered Habitats League** is a Southern California nonprofit regional conservation organization dedicated to ecosystem protection and sustainable land use.

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Executive Summary

The Center for Biological Diversity and Endangered Habitats League submit this petition to list the Quino checkerspot butterfly (*Euphydryas editha quino* Behr) as endangered throughout its range in California pursuant to the California Endangered Species Act (CESA, California Fish and Game Code §§ 2050 et seq.). As outlined in this petition, without the protection of the CESA, the Quino checkerspot butterfly is highly likely to become further imperiled and go extinct in the very near future. The Quino checkerspot butterfly was once a common butterfly throughout Southern California but has lost over 75% of its habitat, largely due to sprawl development. The Quino checkerspot butterfly is now only known in 62 potential sites in Southern San Diego and South-western Riverside Counties; of those 62, the butterfly has been observed in only 33 sites (53.2%) in the last 10 years and all are threatened by climate change, habitat destruction, degradation, and fragmentation, invasive plants, drought, and/or fire.

The Quino checkerspot butterfly exhibits of boom and bust metapopulation dynamics with an extended larval diapause that has allowed it to adapt and survive the variable precipitation of southern California. These natural history characteristics make protection of core sites and connectivity between sites especially imperative for the butterfly's conservation and recovery to avoid incremental extirpation and eventual extinction. However, despite being federally protected as endangered under the Endangered Species Act (ESA), the Quino checkerspot butterfly's few remaining core populations are imminently threatened by large-scale sprawl development as well as habitat fragmentation, climate change, nitrogen pollution, invasive species, and also the construction of a border wall between the United States and Mexico in its little remaining critical habitat.

The United States Fish and Wildlife Service (FWS) designated 171,605 acres of critical habitat for the Quino checkerspot butterfly in 2002 but despite further declines and loss of habitat, the FWS reduced the designated critical habitat by 63.8% to 62,125 acres in nine disparate units, a decision that was based largely on economic reasons. Since its federal ESA listing in 1997, the Quino checkerspot butterfly has been included as a covered species in regional habitat conservation plans that have nevertheless resulted in loss of core habitat areas absent substantial or effective protections. Currently there are at least six major development projects in the Quino checkerspot butterfly's few remaining Core populations that are slated to begin imminently or within the next few years. By first decreasing the butterfly's designated critical habitat and then allowing large scale development projects within its few remaining strongholds without requiring adequate protection of the Quino checkerspot butterfly metapopulation dynamics and mitigation of core habitat loss, the FWS has failed to protect the Quino checkerspot butterfly, making it in dire need of increased protections in California as endangered under the CESA.

Introduction

Southern California is a global biodiversity hotspot, made up of extremely diverse habitats and home to over 700 endemic species, many of them rare and threatened (Myers et al. 2000; Chen et al. 2010 p. 165). Over the last several decades, human population growth and substantial land use and land cover change have led to severe habitat destruction and fragmentation as well as biodiversity loss in the region (Vandergast et al. 2008; Chen et al. 2010; Riordan & Rundel 2013; Phillips 2019). The Quino checkerspot butterfly (*Euphydryas editha quino* Behr) (referred throughout this petition as "Quino" or "QCB") was once widespread from coastal Los Angeles and Orange Counties, west to Riverside and southwestern San Bernardino Counties, and south to San Diego County and may well have been the most abundant butterfly in southern California.

The Quino checkerspot butterfly exists as a network of metapopulations with the survival of each population dependent on both the local habitat resources as well as the movement of individuals between patches (Hanski & Gyllenberg 1993; Hellmann et al. 2004). Historically, during years with optimal resource conditions, the Quino checkerspot butterfly had population booms in which there were many thousands of adults (Murphy & White 1984). Rampant development has reduced Quino's habitat by more than 75%, including more than 90% of its coastal distribution (USFWS 1997, 2003 p. 13) and the Quino is now extinct in Los Angeles, Orange, and San Bernardino Counties (Mattoni et al. 1997). Unfortunately, the destruction and fragmentation of core habitat is occurring again in the Quino's few remaining metapopulations in pockets of southwest Riverside and San Diego Counties.

Riverside and San Diego Counties are two of the fastest growing areas of the United States. In the last 10 years, Riverside County's population grew 12.8% and San Diego County's 7.8% compared to 6.1% in all of California (US Census Bureau 2020). In addition, there have been recent calls to increase housing construction to further stimulate the economy and reduce housing scarcity (Ober 2019). In this petition we outline six planned and/or occurring development projects in core Quino habitat, and those are just the currently known projects. Climate change, nitrogen deposition and invasive species are challenging the Quino's survival, but the butterfly will have no chance to naturally adapt if its habitat is destroyed and fragmented due to border wall construction and development.

In concurrence with site-specific management, region-wide management is needed to increase overall connectivity to reduce the negative effects of habitat fragmentation. For metapopulation survival, resilience, and recovery, the Quino needs protection in occupied and unoccupied habitat from sprawl development, degradation, and additional fragmentation across its range. These protections have not occurred while the Quino has been federally protected, and, as such, the butterfly must be protected by the state of California.

Natural History

Taxonomy

The Quino checkerspot butterfly (*Euphydryas editha quino*) was first described by Hans Herman Behr in 1863 and then subsequently named and classified by J. Emmel (USFWS 1997 p. 2314). The Quino is a member of the family Nymphalidae, the subfamily Nymphalinae, and tribe Melitaeinae and recognized as a valid subspecies (Integrated Taxonomic Information System 2020a). The Quino is one of 26 subspecies of Edith's checkerspot butterfly (*Euphydryas editha*) (Integrated Taxonomic Information System 2020b).

Description

Quino checkerspot butterflies have a 1.5 inch (4 cm) wingspan and checkered wings alternating in red, black, and cream colors on top and red and cream on the underside, the adult butterfly's abdomen has a dorsal red strip (USFWS 2003 p. 6) (Figure 1). Larvae of the Quino checkerspot hatch with a yellow coloration but after the first molt are gray with black markings, and after the second molt take on a characteristic dark-black coloration with eight to nine orange tubercles (Figure 1); pupae are mottled black on a gray background (USFWS 2003 p. 6). Adult Quino checkerspot butterflies are larger than the parapatric subspecies *E. editha agustina*, and compared to the nominotypical *E. editha*, Quino has increased orange/red scaling and larger cream-colored spots (Mattoni et al. 1997 p. 100).

Figure 1. Adult Quino checkerspot butterfly (top), photo credit: Robert A. Hamilton, Hamilton Biological. Mature Quino checkerspot butterfly larva (bottom), photo credit: G.R. Ballmer.

Habitat and Host Plants

The Quino checkerspot is found in grasslands, open chaparral, and coastal shrublands with sparse vegetation surrounded by bare patches up to 5,000 feet in elevation (Figure 2) (Mattoni et al. 1997 p. 112; USFWS 1997, 2003). Habitat is best defined by presence of larval host plants, nectar resources, microtopography, cryptobiotic crust, and presence of episodic disturbances (Mattoni et al. 1997 p. 112). The FWS (USFWS 2002 p. 18362) defined primary constituent elements of Quino habitat as: (1) Grassland and open-canopy woody plant communities, such as coastal sage scrub, open red shank chaparral, and open juniper woodland, with host plants or nectar plants; (2) Undeveloped areas containing grassland or open-canopy woody plant communities, within and between habitat patches, utilized for Quino checkerspot butterfly mating, basking, and movement; or (3) Prominent topographic features, such as hills and/or ridges, with an open woody or herbaceous canopy at the top determined relative to other local topographic features. For nectar, Quino adults prefer flowers with landing platforms and short corollas less than 0.43 inches (USFWS 2009b p. 10). Specifically, adult Quino have been documented to visit species in the following genera: *Cryptantha, Eriodictyon, Gilia, Lasthenia, Lomatium, Muilla*, and *Plagiobothrys* (Preston et al. 2012 p. 281).

The primary host plants that have been documented for the Quino checkerspot butterfly include dwarf plantain (*Plantago erecta*), woolly plantain (*Plantago patagonica*), Coulter's snapdragon (*Antirrhinum coulterianum*) (USFWS 2009b p. 9; Preston et al. 2012 p. 281), and possibly Nuttall's snapdragon (*Antirrhinum nuttallianum*) (Pratt 2020b). Quino also use Chinese houses (*Collinsia concolor*) as host plants at higher elevations where the plant is small (Pratt email 3.25.20) (Pratt & Pierce 2010; Parmesan et al. 2015 p. 9). Quino may also use owl's clover (*Castilleja exserta*) and stiff branch bird's beak (*Cordylandthus rigidus*) as secondary host plants if the primary host plants are not available or senesce before larval maturity (USFWS 2009b p. 9). Quino appear to utilize different host plants in different proportions depending on microhabitat and annual climate conditions (Pratt 2020b). The persistence and availability of Quino host plants depend on microclimate factors. Years with little rainfall can cause host plants to senesce or be completely consumed before seed set with regeneration relying on seed bank germination in subsequent wetter years (Murphy & White 1984 p. 352). Host plant presence and suitability also vary annually with respect to soil type, slope aspect, vegetation cover, and sun exposure; host plants growing on a warmer southern facing slope will likely grow and mature earlier in the season than those growing on a cooler northern facing slope or those growing in shade (Osborne & Ballmer 2019 p. 1).

The Quino and its hosts plants have also been associated with cryptobiotic crust, or crusts on the soil formed by blue-green algae, lichens, mosses, fungi, and bacteria that hold in moisture, improve the availability of minerals to plants, limit invasive plants, and reduce soil erosion in arid environments (Mattoni et al. 1997 p. 112). Because cryptobiotic crusts are darker than the surrounding earth, they are warmer and serve as locations for thermoregulation for the Quino larvae and adults (Mattoni et al. 1997 p. 113).

Figure 2. Quino habitat showing undisturbed coastal sage scrub with native wildflowers, bare ground, and cryptobiotic crust. Photo credit: Robert A. Hamilton, Hamilton Biological.

To complete development into the pupal stage before host plants dry up, post-diapause larvae seek microclimates with low shade, bare ground, low grass and shrub cover, and presence of *P. erecta* (Osborne & Redak 2000 p. 112). Larvae diapause in soil, leaf litter, under rocks, and potentially in native bunch grasses or shrub covered areas (Osborne & Redak 2000 p. 113) and subsequently pupate in the leaf litter or within native vegetation such as California Buckwheat (Pratt & Emmel 2010). As such, as a larva—the stage in which it spends the majority its life—the Quino requires heterogeneous habitat consisting of sunny southern facing slopes with shaded areas as well as both open areas with food plants and nearby areas with larger vegetation.

Quino metapopulations are found in a dynamic mosaic of fire climax communities in which host plants are initially dominant following a periodic wildfire but over time replaced by perennial shrubs until the next fire (Osborne & Ballmer 2019 p. 5). Thus, "fire plays an important role in determining the temporal-spatial distribution of reproductive resources for the Quino. This year's patch of 'dense chaparral' could, following wildfire, become the next season's field of wildflowers and Quino host plants" (Osborne & Ballmer 2019 p. 5). Permeable (e.g. not developed or not fragmented by a highway or high wall) dispersal habitat is also important for Quino adults to fly between habitat patches in search of mating partners and isolated larval hosts (Osborne & Ballmer 2019 pp. 4–6).

Life Cycle and Behavior

The Quino checkerspot butterfly exists in four main life stages: the highly active winged adult butterflies and the less conspicuous eggs, larvae, and pupae. The larval stage is divided into five to seven instars (growth stages) and there is typically one generation of adults per year. Adult emergence from pupae is staggered, resulting in a four to six week flight period beginning between late February and early May, depending on weather conditions, with each adult butterfly living up to two weeks (USFWS 2002 p. 18356). Although little is known regarding the relative length of time each life stage takes for Quino checkerspot butterflies, research into the conspecific bay checkerspot butterfly (*Euphydryas editha bayensis*) reveals that the butterflies spend approximately less than 5% of their lives as adults, about 80% as a caterpillar, 5% as a pupa, and 5% in the egg stage (White 1986).

Quino are univoltine (Mattoni et al. 1997 p. 106). Females lay egg masses with a minimum of 39 eggs per mass and up to 120-180 eggs, laying a total lifetime range of 400-800 eggs; the number of egg masses laid are dependent on the amount of nectar fed upon by the female (Mattoni et al. 1997 p. 106). Larvae that hatch from eggs undergo two or three molts and enter an obligate diapause as either third or fourth instar larvae, likely molting to the fourth instar when sufficient food is present. Larvae that survive come out of diapause after the winter rains the following year to consume any germinated host plants and undergo up to seven total instars before pupating under plants or rocks (Mattoni et al. 1997 p. 106). Adult butterflies eclose after approximately 10 days of pupation.

Once the butterfly emerges from the chrysalis, adult females actively mate and lay eggs as well as seek nectar plants for feeding. Mating behavior is important in the Quino's population dynamics; if populations are abundant, males actively fly to search for females that wait on the ground or on low lying host plants, whereas in areas with more sparse resources, males perch on and defend high points, a behavior known as "hill topping", and females move to find mates (Mattoni et al. 1997 pp. 109–110). After mating, males insert a mating plug to prevent females from copulating further to ensure paternity (Mattoni et al. 1997 p. 106).

Larval Diapause

The Quino checkerspot butterfly has evolved to survive in the hot dry summers of the Mediterranean climate of southern California by entering larval diapause. Quino host plants dry up before larvae can complete development; larvae that survive the late spring senescence of host plants enter an obligatory diapause for the summer and fall. During the first two instars, pre-diapause larvae cannot move more than a few centimeters and are usually restricted to the primary host plant species (USFWS 2002 p. 18356). Pre-diapause larvae are the most vulnerable Quino life stage due to their dependence on late season host plants that quickly dry up and senesce prior to winter rains (Mattoni et al. 1997 p. 107). During years with low host plant density, larvae will pupate when they are small, resulting in smaller females that lay fewer eggs (Murphy & White 1984 p. 353). Further, mortality can be high for diapausing larvae, especially if not well fed prior to diapause (Mattoni et al. 1997 p. 107).

Larvae have been found in diapause in or near the base of native shrubs (USFWS 2009b p. 12) but can also do so in cracks in the soil, under logs or rocks, in leaf litter or under bark, making them difficult to locate during surveys (USFWS 2009b; Preston et al. 2012). Larvae come out of diapause in response to winter rains, and thus host plant germination, and can re-enter diapause if there is not enough food to reach pupation, sometimes repeating this cycle for multiple years especially during drought conditions (Mattoni et al. 1997 p. 107; USFWS 2009b; Pratt & Emmel 2010; Preston et al. 2012). Even under apparently ideal developmental conditions of temperature, moisture, and host plant quality, a large percentage of larvae, after breaking diapause and a brief period of activity, may re-enter diapause for another year or more (Pratt & Emmel 2010). Thus, a large portion of a Quino population is likely to remain as larvae, undetected by surveyors following standard USFWS protocol for surveying adult Quino (Osborne & Ballmer 2019 p. 2). The ability of Quino to "hedge its bets" by keeping a reservoir of larvae allows it to survive extended drought and other adverse environmental conditions when larval hosts are scarce or unavailable (Osborne & Ballmer 2019 p. 2).

Adult Dispersal

Quino adult dispersal behavior varies between very little movement to high vagility, depending on available host and nectar resources and population size. The prior year's rainfall impacts the density of post-diapause larvae which in turn impacts current availability of host plants, while a current year's rainfall impacts availability of host and nectar plants and thus adult vagility (Murphy & White 1984 fig. 1). Adults exhibit greater dispersal behavior during warm and dry years when host plants senesce earlier and thus become unsuitable for oviposition (Murphy & White 1984 p. 350; Osborne & Ballmer 2019 p. 1). High vagility can also occur during wet years due to high adult abundances, competition for oviposition sites, and host plant consumption by post-diapause larvae (Murphy & White 1984 p. 351). For example, during a boom year, gravid females were found several kilometers from population centers in unsuitable habitat (Murphy & White 1984 p. 351). Within a habitat patch, adult Quino have been found to move up to 200 meters (656 feet) between host plants and nectar sources and they generally avoid flying over objects taller than seven to eight feet (USFWS 2009b p. 10; Greenwald et al. 2017 p. 16; Peters et al. 2018 p. 741).

Metapopulation Dynamics

As a subspecies, the Quino checkerspot butterfly exists as a network of metapopulations, specifically as core-satellite metapopulations that consists of an interdependent network of populations on patches of suitable habitat that are geographically separated from each other by unsuitable habitat (USFWS 2009b; Osborne & Ballmer 2019). Quino populations are maintained through metapopulation dynamics of colonization and extirpation between habitat patches with the survival of each subpopulation dependent on both the local habitat resources as well as the movement of individuals between patches (Hanski & Gyllenberg 1993; USFWS 2002 p. 18357).

A core, or source, patch population is one in which the number of births exceeds the number of deaths, resulting in a net emigration of individuals to satellite patches and thus are centers of high population abundance, due to geographic size, quality of resources, connectivity to other patches, and high reproductive output (Howe et al. 1991; Hanski & Gyllenberg 1993). Core patches serve as a source of Quino individuals that repopulate other patches with suitable habitat (Murphy and White 1984; Mattoni et al. 1995). According to the final rule designating critical habitat for the Quino (USFWS 2009a p. 28778), a core population is a habitat patch where at least two of the following criteria apply: (1) 50 or more adults are reported during a single survey at least once; (2) immature life history stages are recorded; or (3) the geographic area within the occurrence complex (i.e. metapopulation) is greater than 1,290 acres (522 ha, or the size of the smallest core occurrence complex where reproduction has been documented and records indicate long-term resilience).

During years with little rainfall and host plant availability, Quino will not occupy smaller, more isolated habitats known as “satellite” patches and local extirpation will occur as a natural metapopulation process (Murphy & White 1984 p. 353). Quino populations in the larger, more connected habitats will survive in those dry years and become the sources of individuals who can recolonize the satellite patches during wet years, allowing Quino to persist in a region (Murphy & White 1984 p. 353). Thus, single patches of suitable habitat cannot be viewed in isolation and functional connectivity between patches is key for Quino persistence across a region. As recognized by the FWS: “Maintenance of landscape connectivity (habitat patches linked by intervening dispersal areas) is essential in order to maintain metapopulation resilience. Land use changes that limit dispersal between habitat patches and isolate local populations by compromising landscape connectivity can be just as detrimental to metapopulation survival as those that destroy or reduce the size of habitat patches” (USFWS 2002 p. 18357).

The loss of occupied or unoccupied satellite patches via habitat destruction and/or connectivity leads to individuals effectively being restricted to only core habitat with the inability to maintain high abundances over time and space. However, the loss of a core patch is especially devastating to Quino persistence and survival; entire Quino metapopulations in Los Angeles, Orange, and San Bernardino counties were lost due to core patch habitat destruction (Mattoni et al. 1995; Harrison 1989; Harrison et al. 1988; Hanski et al. 1996). Thus, the loss of any Quino core or source populations due to habitat destruction or degradation creates a "ripple effect of irreversible long-term extinctions" (Murphy & White 1984 p. 353).

Population Trend, Distribution, and Abundance

Due to the ephemeral nature of Quino checkerspot butterfly populations, it is not always accurate to consider occupied population sites as permanently occupied (USFWS 2009b pp. 5–6). Any snapshot of abundance is not a useful metric for Quino population occurrence, as the species can experience an order of magnitude change in abundance every 5-20 years, depending on rainfall and temperatures (USFWS 2009b p. 7; Preston et al. 2012; Strahm 2018 p. 1). Instead, FWS defines Quino occupancy by "occurrence complexes" using population-scale occupancy, or "areas used by adults during the persistence time of a population (years to decades)" (USFWS 2003 p. 24, 2009b pp. 5–6). Occurrences within approximately 1.2 miles (2 kilometers) of each other are considered to be part of the same occurrence complex, as they are proximal enough that the observed butterflies are likely to have come from the same population (USFWS 2003 p. 35, 2009b p. 5). Thus, multi-year studies are required to determine Quino population distributions (USFWS 2009a p. 28777). However, 'boom' years with high population numbers appear to now occur less frequently and be of lesser magnitude than in the past (Strahm 2018 p. 1). There are clear regions of occupancy that have been lost for many years that are considered extirpated while there are regions that continue to be occupied variably over the years and some regions that have 'new' populations either recently found or colonized. See the map below for all historic and current Quino occurrences recorded by the FWS and the California Natural Diversity Database (Figure 3).

'Core' occurrence complexes are also delineated by FWS and determined based on geographic size, reported abundance, documented reproduction, and repeated observations and are areas that contain habitat that can support local source populations for the metapopulation (Murphy & White 1984 p. 353; Mattoni et al. 1997 p. 111; USFWS 2003 pp. 25–26). In the final revised critical habitat rule (USFWS 2009a p. 28776) FWS defines a Core occurrence complex as an area where at least two of the following criteria apply: (1) 50 or more adults have been observed during a single survey; (2) immature life stages have been recorded; and (3) the geographic area within the occurrence complex (i.e., within 0.6 mile (1 kilometer) of subspecies occurrences) is greater than 1,290 acres (522 hectares). FWS also described 'habitat-based population distributions' for Core occurrence complexes as any contiguous habitat within an occurrence complex and within an additional 0.6 mile (1 kilometer) of an occurrence complex (USFWS 2009a p. 28776). Thus, occurrence complexes are areas of Quino metapopulations.

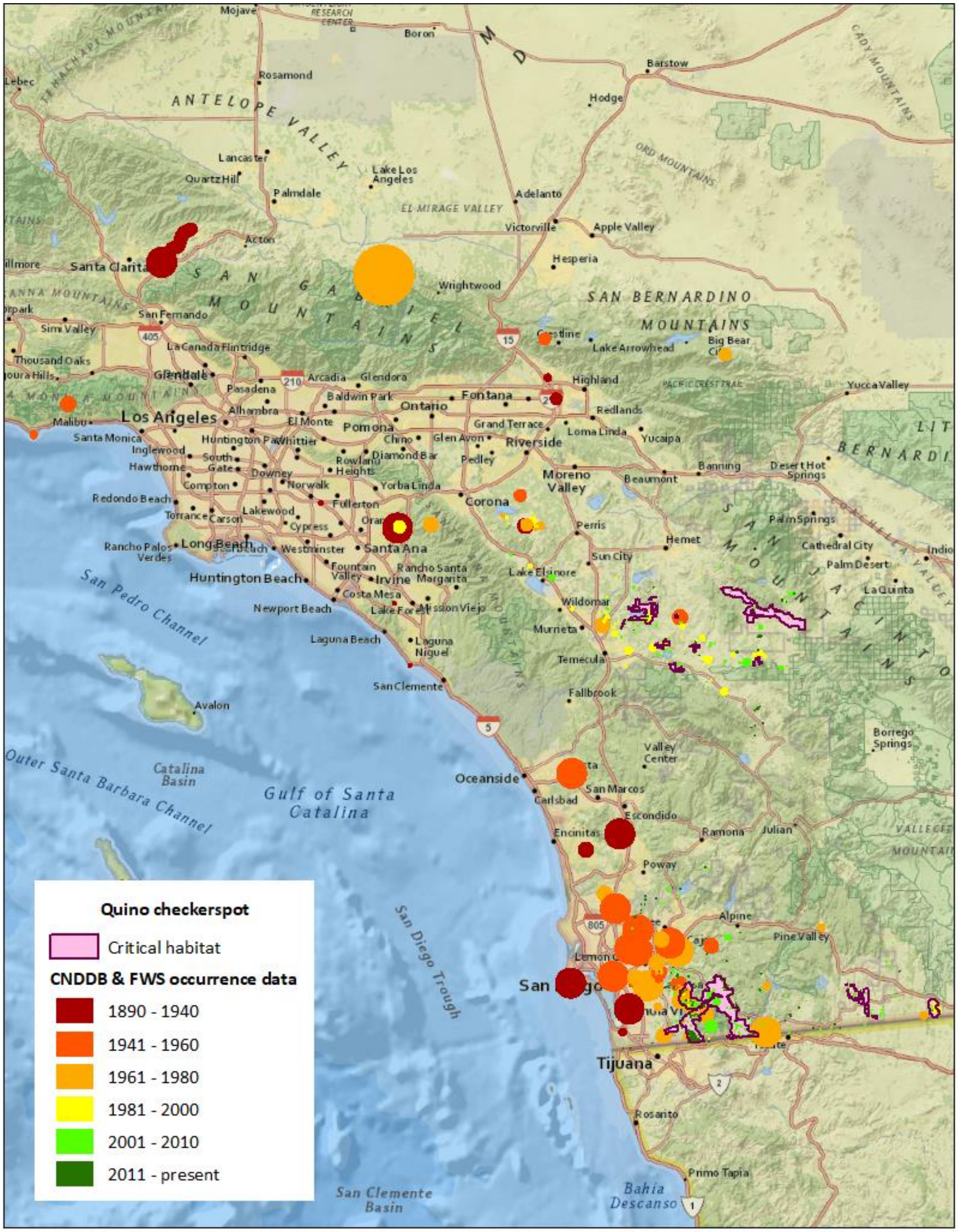

Figure 3. Historic and current occurrences of the Quino checkerspot butterfly from 1890 to present with current critical habitat. Data obtained from FWS and the California Natural Diversity Database (CNDDB). Map by Kara Clauser.

Historic Population Trend, Distribution, and Abundance

Prior to 1990, the Quino checkerspot was found in an estimated 40 sites in Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties in California and in northern Baja California, Mexico (Figures 4 and 5) (Mattoni et al. 1997 pp. 100, 104). Documented specimen localities and maps of vegetation communities indicated that the Quino checkerspot may have had a continuous distribution across southern California from Point Dume to Ensenada and inland up to 60 miles (Mattoni et al. 1997 pp. 104–105). In the 1950s, collectors described the butterfly as occurring on every coastal bluff, inland mesa top, and lower-mountain slopes in San Diego County and coastal northern Baja California (Murphy and White 1984). Large populations also were observed during this period in San Diego, Riverside, and Orange counties; in spring of 1977, hundreds to thousands of adults were observed in southern San Diego County at four population centers: Lower Otay, Upper Otay, Brown Field on Otay Mesa, and La Pressa Rodriquez near Tijuana (Murphy & White 1984 p. 351).

By the 1980s, more than 75% of its historical range and at least 95% of its coastal bluff and mesa habitat had been destroyed by urban development, agriculture, grazing, and non-native, invasive species (Mattoni et al. 1997 p. 105). The 1988 federal petition to list the Quino as endangered suggested it was extinct. Yet it was not until 1997 that the U.S. Fish and Wildlife Service (FWS, USFWS, Service) protected it under the Endangered Species Act, and it was that same year that the agency's scientists succeeded in locating an extant population.

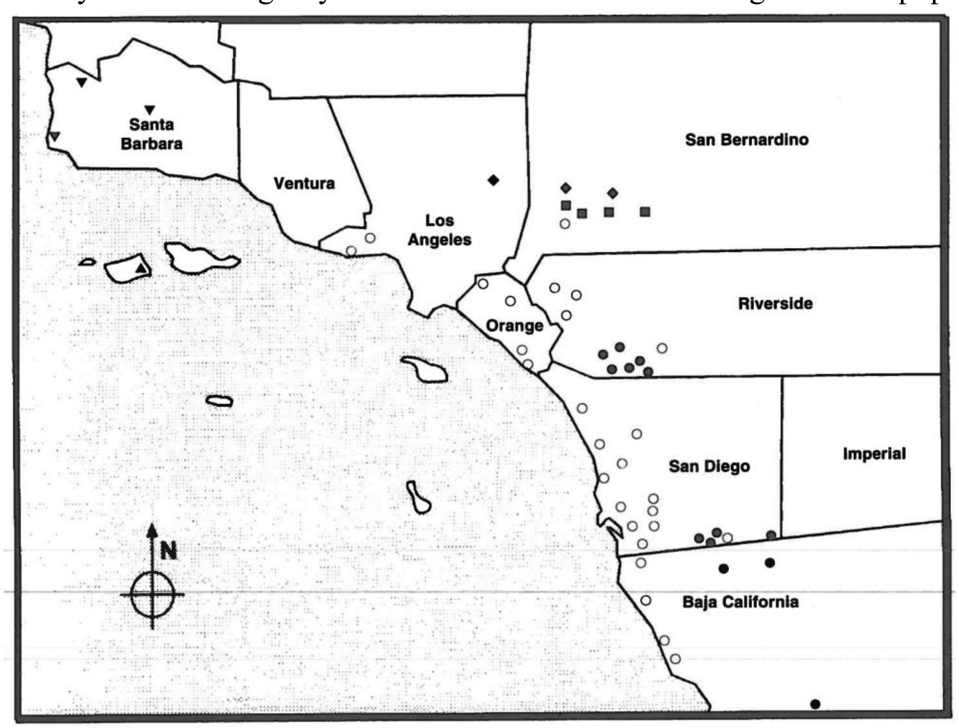

Fig. 1. Historic and current distribution of Quino checkerspot butterfly in southern California and Baja California, showing distribution of nearby subspecies of *Euphydryas editha*. Legend: ○ *quino* pre-1990, ● *quino* post-1990, ▲ *insularis*, ■ *augustina*, ◆ new subspecies, ▼ *editha*.

Figure 4. From Mattoni et al. (1997 pg. 100) see figure for legend.

Table 1. Localities for *Euphydryas editha quino* and most recent date of collection or observation. A list of museum specimens is available from the authors upon request.

Mexico			
Estrado de Baja California		Spring Valley	1969
N of Ensenada	1935	SE of El Cajon	1970
Las Animas Canon	1935	Proctor Valley	1971
Mosquito Springs	1936	Otay Lake	1973
Rodriguez Dam, Tijuana	1977	Mt. Palomar	1975
S of Salsipuedes	1979	San Diego	1976
N of Sordo Mudo	1979	Chula Vista	1978
Table Mt. (near Rosarita Beach)	1979	Little Cedar Canyon	1979
Turn off to Ojos Negros	1981	Mesa E of Otay Reservoir	1979
Valle de La Trinidad, Aquaito Spring	1994	Otay Mesa	1980
N of El Testerazo	1996	Dictionary Hill	1981
S of El Condor	1996	Brown Field	1997
California		Otay Mt., ridge S of O'Neal Canyon	1997
San Diego County		South Otay Mt., Marron Valley	1997
San Francisquita Pass	1914	Jacumba	1997
Warner's Dam	1916	North slopes of Tecate Peak	1997
South San Diego	1917	**Riverside County**	
Santa Fe Ranch	1930	Sage	1951
Lake Hodges	1932	Lake Elsinore	1983
Rancho Santa Fe	1933	Gavilan Hills	1985
Alta Vista	1934	Murrieta Hot Springs	1997
Adobe Falls, San Diego	1948	Aguanga	1997
Division Street, San Diego	1948	Oak Mountain	1997
Vista	1951	Temecula	1997
Dehesa	1957	Lake Skinner	1997
San Miguel Mt.	1957	**Orange County**	
El Cajon	1958	Hills E of Orange Co. (Irvine) Park	1917
La Presa, San Diego	1958	Anaheim	1930
Miramar	1960	Laguna Lakes	1931
Mission Gorge	1960	Hills N of Orange Co. (Irvine) Park	1934
Tecate Mt.	1961	Dana Point	1936
Fletcher Hills near El Cajon	1963	Irvine Park	1937
Sweetwater Dam/Reservoir	1969	Hidden Ranch	1967
Encanto	1969	**Los Angeles County**	
Kearney Mesa	1969	Tapia Camp, Santa Monica Mts.	1947
Paradise Mesa, National City	1969	Pt. Dume	1954

Figure 5. Historic Quino sites known before 1997 from Mattoni et al. (1997 pg. 104) shows the Quino historic range extent.

By 1997 the number of Quino populations decreased by 67.5% and it was extirpated from Los Angeles, Orange, and San Bernardino Counties (Mattoni et al. 1997 p. 100; USFWS 1997). Since listing in 1997, the Quino checkerspot had been found in up to 15 sites within six core occurrence complexes in Riverside County and San Diego County (USFWS 1997, 2003, 2009b p. 6). In Riverside County, the Tule Peak complex contained the highest density and produced more emigrants than any other area; in San Diego County, the core Otay occurrence complex (consisting of Otay Valley, West Otay Mountain, Otay Lakes, Proctor Valley, Dulzura, and Honey Springs occurrence complexes) was recognized as "an area of key landscape connectivity for all subpopulations in southwest San Diego County" (USFWS 2009b p. 7). Marron Valley, West Otay Valley, Jamul Butte, and Rancho San Diego/Jamul are also a part of the Otay habitat-based population distribution (USFWS 2009b p. 7). Four of six new occurrence complexes (South San Vicente, Sycamore Canyon, Fanita Ranch, and North East Miramar) are part of the

San Vicente core habitat-based population distribution in Central San Diego County (USFWS 2009b p. 7). In addition, a new occurrence complex east of Campo was included as part of the Jacumba occurrence complex in south-central San Diego County (USFWS 2009b p. 7).

Critical habitat was designated for the Quino in 2002 with 97,030 acres (39,260 ha) in Riverside County and 74,575 acres (30,180 ha) in San Diego County (USFWS 2002 p. 18363). The critical habitat units were configured "to provide room for metapopulation dynamics, which is essential for the conservation of the species, including dispersal corridors" (USFWS 2002 p. 18361). According to the FWS, there were 147,359 acres (59,634 hectares) of mapped occurrence complexes extant at the time of listing or documented post-listing with approximately 42% on public lands or privately-owned preserves, 19% on privately owned lands likely to be conserved under a Habitat Conservation Plan (HCP), 24% on private and tribal lands where the likelihood of habitat loss was variable, and 15% destroyed by development or land use changes (USFWS 2009b p. 14). As a result of a lawsuit and resulting settlement brought forth by the Homebuilders Association of Northern California and others, the FWS reduced the designated critical habitat by 63.8% to 62,125 acres in nine disparate units based on economic, national security, and "other relevant impacts" (Figure 6 and Table 1)(USFWS 2009a p. 28781).

Current Population Trend, Distribution, and Abundance

By 2012, Quino were clustered in the foothills of southwestern Riverside County and southern San Diego County (Preston et al. 2012 p. 284). A table of 'current' sites and their status, date last observed, location in Recovery Units, and current threats can be found in the 2019 Draft Recovery Plan Amendment (USFWS 2019). Quino population collapses have largely mirrored urbanization and extreme drought, both of which have only grown as threats in California as described in this petition. Loss of single, large or core population creates "a ripple effect of irreversible long-term extinctions,"; this well-accepted hypothesis—first put forth by Murphy and White (1984 p. 355) and which has continued to be relied upon in the Quino's listing (1984 p. 355; USFWS 2009b pp. 8–9)— is one that holds even more relevance for Quino's existence today, given increasingly high levels of development and more severe climate change projections. Today, there are few large, stable populations that can act as sources to surrounding non-core habitat patches, and dispersal between patches is further inhibited by the highly fragmented landscape in southern California (Strahm 2018 p. 1). The study by Preston et al. (2012) provides strong and region-wide evidentiary support for the ongoing operation of this process of development-triggered metapopulation collapse and extinction. Significant development within a one km radius was a strong predictor of whether a population remained extant or went extinct (Preston et al. 2012 fig. 3, p. 287).

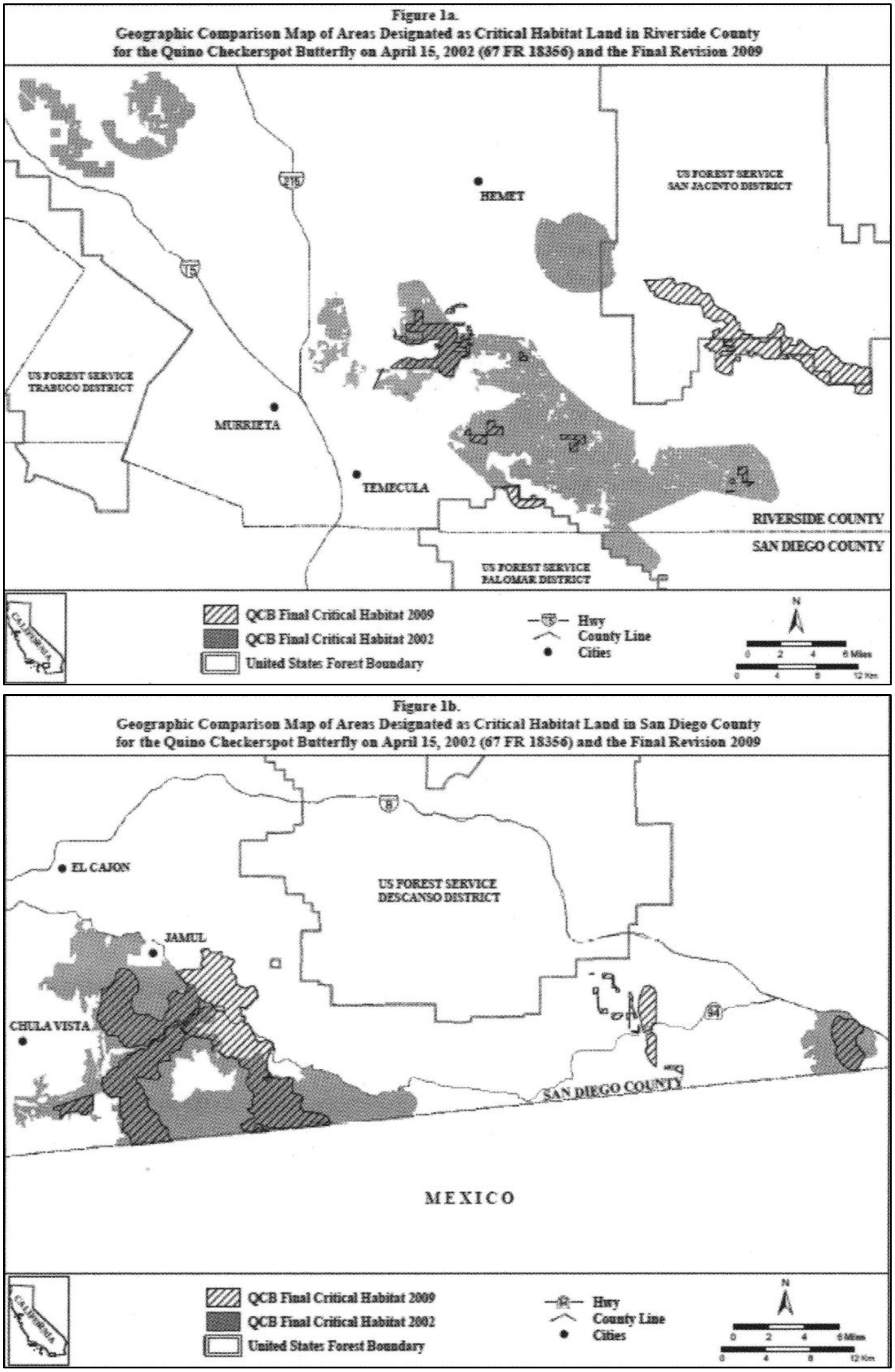

Figure 6. Reductions in designated critical habitat in Riverside County (top) and San Diego County (bottom) from 2002 to 2009 (USFWS 2009a).

Table 1. Changes between the April 15, 2002, Quino critical habitat designation and the revised final designation. Acreage values are approximate. From USFWS (2009a pp. 28801–28802).

Critical Habitat Unit in this Final Rule	**County**	**Recovery Plan occurrence complexes [1] (place names)**	**2002 Designation of Critical Habitat and ac (ha) [2]**	**2009 Final Revised Critical Habitat Designation and ac (ha)**
1. Warm Springs	Riverside	Warm Springs Creek and Warm Springs Creek North	Majority designated in Unit 2; 0 (0)	Entire unit excluded
2. Skinner/ Johnson	Riverside	(Lake) Skinner/ Johnson (Ranch)	Partially designated in Unit 2; 4,705 (1,904)	Partially designated in Unit 2; 5,443 (2,203), partially excluded, 6,560 (2,655)
3. Sage	Riverside	(Community of) Sage and San Ignacio (Ridge)	Majority designated in Unit 2; 123 (50)	Partially designated in Unit 3; 123 ac (50 ha), partially excluded, 2,569 ac (1,040 ha)
4. Wilson Valley		Wilson Valley	Designated in Unit 2; 463 (187)	Partially designated in Unit 4; 463 (187), partially excluded, 4,350 (1,760 ha)
5. Vail Lake/Oak Mountain	Riverside	Vail Lake, Pauba Valley, and (Communities of) Butterfield/Radec	Majority designated in Unit 2; 819 (332)	Partially designated in Unit 5; 1,788 (724), partially excluded, 6,398 (2,589)
6. Tule Peak	Riverside	Tule Peak (Road), Southwest Cahuilla (Reservation), and Silverado (Ranch)	Majority designated in Unit 2; 15 (6)	Partially designated in Unit 6; 326 (132), partially excluded, 6,106 (2,471)
7. Bautista	Riverside	Bautista Road, Pine Meadow, Lookout Mountain, and 3Horse Creek	Not essential	Partially designated in Unit 7; 13,880 (5,617), partially excluded, 79 (32)
8. Otay	San Diego	Otay Valley, West Otay Mountain, Otay Lakes/ Rancho Jamul, Proctor Valley, Marron Valley, (Community of) Dulzura, and Honey Springs	Majority designated in Unit 3; 25,325 (10,249)	Partially designated in Unit 8; 34,941 (14,140), partially excluded, 1,782 (721)
9. La Posta/Campo	San Diego	[3](Communities of) La Posta/Campo	Not essential	Partially designated in Unit 9; 2,647 (1,071), partially excluded, 5,740 (2,323)
10. Jacumba	San Diego	Jacumba	Designated as part of Unit 4; 2,514 (1,017)	Designated as Unit 10; 2,514 (1,017)
[4]Brown Canyon Subunit	Riverside	Brown Canyon	Designated subunit of Unit 2; 0 (0)	Determined not to be essential
[5]Lake Matthews	Riverside	Harford Springs (Park), [6]Lake Matthews Population Site	Unit 1; 0(0)	Determined not to be essential
[7]Otay	San Diego	(National Wildlife Refuge) NWR Rancho Jamul, NWR Los Montanas, Hid-den Valley, (Community of) Jamul, West Otay Mesa, Barret Junction, (City of) Tecate (border area)	Designated in Unit 3; 0 (0)	Determined not to be essential
Totals			33,964 (13,745)	62,125 (25,141) designated 36,270 (14,678) excluded

1 All occurrence complexes in proposed revisions to critical habitat are now part of a core occurrence complex, except Pine Meadow, Lookout Mountain, and Horse Creek. The geographic analysis of occurrence complexes in this table is based on habitat-based population distributions described in this final revised critical habitat rule. 2 Area designated in this rule that was also included in 2002 designated critical habitat units (67 FR 18356). 3 New occurrence complexes described in the 2008 proposed revised designation (73 FR 3328) that were not described in the Recovery Plan. 4 The Brown Canyon subunit in the 2002 final designation was not included in proposed revisions to critical habitat. 5 The Lake Matthews Unit in the 2002 final designation was not included in proposed revisions to critical habitat. 6 A ''historically occupied population site'' described in the Recovery Plan (not an occurrence complex). 7 The Otay Unit was Unit 3 in the 2002 final critical habitat rule (67 FR 18356). This row describes Recovery Plan occurrence complexes not included in Unit 8 of the proposed revisions to critical habitat.

Riverside County

Coinciding with droughts that began in 2012, the Quino checkerspot has been declining and is now extirpated from both the northwest Riverside core complex and one of the two core complexes in southwest Riverside (USFWS 2019). Specifically, Quino are extirpated from Northwest Riverside from the Lake Mathews, Canyon Lake, and Harford Springs (a Core area) areas as well as Pauba Valley in South Riverside and from Warm Springs Creek Core area (USFWS 2019 p. 5). In 2018, 54 total adult Quino were found in only four of the Core Areas (Silverado/Tule Peak, Oak Mountain, Johnson Ranch/Lake Skinner, and Sage) and one of the non-core satellite areas (Cactus Valley) (Figure 7) (Biological Monitoring Program 2019 pp. 7–9). While there were four adult Quino observed at the Sage Core Area in 2018, Quino were present in only half of the past 11 years in very low abundances; the site is isolated and shrinking in size every year due to invasive grasses; thus, without management, the Quino may be soon extirpated from this area (Biological Monitoring Program 2019 p. 12). Habitat quality at Johnson Ranch/Lake Skinner has also been decreasing over the past decade despite its adjacency to the Multi-Species Reserve sentinel site (Biological Monitoring Program 2019 p. 12). Silverado/Tule Peak and Oak Mountain are the remaining Quino Core Areas, yet Oak Mountain continues to be developed and impacted by off-road vehicles (Biological Monitoring Program 2019 p. 15).

According to the 2019 Recovery Plan Amendment, Quino is extant in 11 sites within Riverside County and in 17 sites at the border between Riverside and San Diego Counties; Quino have been observed in only 12 out of those 28 sites (42.9%) in the last 10 years and all are threatened by a combination of the following: climate change, habitat destruction, degradation, and fragmentation, invasive plants, drought, and fire (USFWS 2019 pp. 5–11).

Riverside County is home to the majority of critical habitat units that were eliminated or reduced in 2009 with the revised critical habitat rules (Figure 6 and Table 1) (USFWS 2009a). The Warm Springs unit (Unit 1, 2,684 acres) was entirely excluded, 6,560 acres of Skinner/Johnson (Unit 2), 2,569 acres of Sage (Unit 3), 4,350 acres of Wilson Valley (Unit 4), 6,398 acres of the Vail Lake/Oak Mountain (Unit 5), and 4,903 acres of Tule Peak (Unit 6) were excluded from protection as critical habitat because the area is "owned by or are under the jurisdiction of the permittees of the Western Riverside County MSHCP" (USFWS 2009a p. 28809). Major losses occurred in Northwest Riverside Subsequent to the removal of critical habitat designation; according to the FWS Recovery Plan Amendment (USFWS 2019 p. 3):

> The former Northwest Riverside subsequently hit an extirpation threshold, where resilience was irretrievably lost and all occurrence complexes within the unit were extirpated (including the Harford Springs Core Occurrence Complex). The entire Northwest Riverside Recovery Unit is now believed to be unoccupied, and not likely to be recolonized without assistance. Furthermore, one of the two core occurrence complexes in the Southwest Riverside Recovery Unit (Warm Springs Creek) may be extirpated. These two recovery units are not only highly affected by climate change and drought, but habitat loss has been concentrated in these areas. In western Riverside County approximately a dozen populations are believed to have been permanently extirpated by habitat loss, isolation, or both since recovery plan publication.

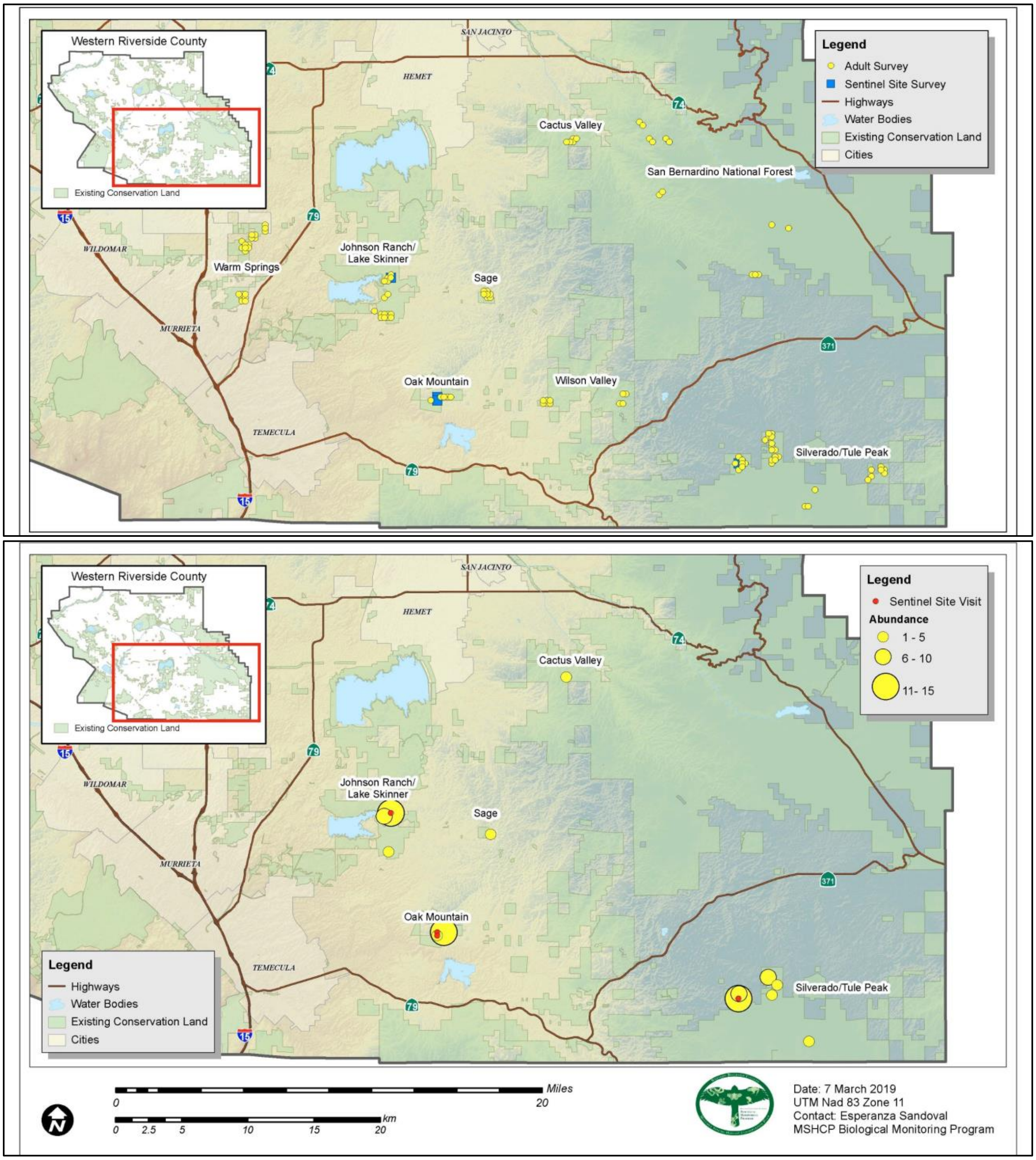

Figure 7. Survey locations in Riverside County (top) and subsequent documented presence and abundance of Quino in survey locations (bottom) in Riverside County in 2018. Maps from Biological Monitoring Program (2019). Noteworthy is the absence of occurrences at Warm Springs Creek, now considered an extinct population.

San Diego County

In San Diego County, Quino was considered extirpated from the following sites in 2012: Lake Hodges, Mira Mesa, Rancho Santa Fe, La Presa, Sweetwater Reservoir, and Dictionary Hill (Preston et al. 2012 p. Appendix). Quino has subsequently been documented at Dictionary Hill in 2017 (USFWS 2019 p. 9). According to the 2019 Recovery Plan Amendment, Quino is extant in 34 sites in San Diego County, including six Core Areas; of those 34 sites, Quino have only been observed in 21 sites (61.8%) in the last 10 years (USFWS 2019 pp. 8–11). Of the potential 34 extant sites in San Diego County, the FWS deems that all are still threatened by all or some combination of the following: climate change effects, habitat destruction, degradation, isolation, and fragmentation, nonnative plant invasion, drought, and fire (USFWS 2019 pp. 8–11).

The Quino checkerspot is generally known to occur at Otay Mesa, Otay Lake, Otay Mountain, Marron Valley, Jamul, Alpine, San Vicente Reservoir, and Jacumba (San Diego County Water Authority & RECON Environmental, Inc. 2010 p. B-172) with the following areas considered Core complexes: Miramar (seen in 2018, Central Marine Corps Air Station, outside any Recovery Unit), Otay (seen in 2018, SW San Diego and partially outside of any Recovery Unit), W Barrett Lake (seen in 2017, outside of any Recovery Unit), Marron Valley (seen in 2018, SW San Diego and partially outside of any Recovery Unit), Campo (seen in 2010, Campo Tribal Reservation, SE San Diego and partially outside of any Recovery Unit), and Jacumba (seen in 2011, SE San Diego) (USFWS 2019 pp. 8–11). Thus, only four of the six Core Areas were known occupied in the last nine years.

Some of the 2002 designated critical habitat units in San Diego County were eliminated or reduced in 2009 (Figure 6 and Table 1) (USFWS 2009a). From the Otay unit (Unit 8) 1,673 acres were excluded due to their coverage by the Chula Vista Subarea Plan and 109 acres of Air Force land; also excluded were 1,282 acres from La Posta-Campo (Unit 9) and 2,572 acres of Navy-owned or controlled land associated with the La Posta Facility "based on our [FWS] determination that the benefits of exclusion outweigh the benefits of inclusion, and that exclusion of this area will not result in extinction of the subspecies" (USFWS 2009a p. 28810).

Factors Affecting the Ability of the Species to Survive and Reproduce

The Quino checkerspot butterfly is threatened by sprawl development, habitat fragmentation, the U.S. southern border wall, *Cannabis* cultivation, grazing, recreation, pollution, invasive species, and climate change, including increased drought and fire frequency, as well as the inadequacy of existing regulatory mechanisms (USFWS 2009b, 2019).

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Development

Human population growth and increased development in Quino habitat has been and continues to be a major contributor to Quino extirpation and extinction risk since 1998 (Preston et al. 2012 pp. 284–287). Development that does not take into account the life history, metapopulation dynamics, and connectivity needs of Quino checkerspot butterflies has led to the loss of vital Quino populations as well as habitat loss, degradation, and fragmentation throughout Riverside and San Diego Counties, two of the fastest growing areas of the United States. In the last 10 years, Riverside County's population grew 12.8% and San Diego County's population grew 7.8% compared to 6.1% in all of California (US Census Bureau 2020). Riverside and San Diego Counties are among the top 10 most populated counties in the United States, and Riverside County had the tenth and fifth highest county-level population growth from 2010-2018 and 2017-2018, respectively (US Census Bureau 2019). Further, there are recent calls to increase housing construction to stimulate the economy and reduce housing scarcity (Ober 2019).

Quino metapopulations which formerly occurred in Los Angeles, Orange, and western Riverside counties were extirpated as urbanization spread (Osborne & Ballmer 2019 p. 2). As described above, the ability of extended larval diapause together with the capacity of adults to colonize new or recolonize habitat patches has allowed for the Quino to adapt and survive the variable precipitation of southern California. Unfortunately, the metapopulation structure of Quino has proven much more vulnerable to the incompatible effects of historical and current urban land uses, and studies have shown that their populations can experience incremental extirpation or 'death by a thousand cuts' (Whitehead et al. 2017; Osborne & Ballmer 2019 pp. 2–3). The impacts of poorly-planned development on and adjacent to Quino population sites are greatly compounded by their domino effects on Quino metapopulation structure and reproductive resources and thus cannot be viewed as "land-proportional" impacts (Osborne & Ballmer 2019 p. 2). As stated by Quino experts: "whether, and at exactly what point, the loss of habitat surpasses an extinction threshold for the metapopulation remains unknown but has been surpassed time and time again both before and after the federal listing of Quino as endangered" (Osborne & Ballmer 2019 p. 2). Absent proactive land protection, ongoing development will inexorably impact remaining Quino populations.

Riverside County

The Quino is a covered species in the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) and is conserved on a *habitat* basis through Cell Criteria, which call for incorporation into 'the Preserve' of various percentages of cells (each cell is 160 acres) or groups of cells, in order to assemble a series of core areas and linkages (Dudek & Associates, Inc. 2003a pp. 3–121). Yet, the Western Riverside Regional Conservation Authority (RCA), which administers the MSHCP, is not currently acquiring private land within Criteria Cells for purposes of Quino conservation (land it did acquire in 2008 in Warm Springs Creek has been unoccupied during the last 11 years of surveys). Set-asides of large blocks of habitat through the land use process is not feasible due to already parceled conditions and due to the large-lot residential zoning present in most Quino habitat (County of Riverside 2015 figs. 3, Table 1, pp. 10, 19). Even if the RCA obtains small and scattered set asides from single family home construction or large lot subdivision, these are small scale and create a fragmented landscape rather than a functioning reserve system that support viable Quino metapopulations.

According to the RCA, occupied sites in the Wilson Valley Core Area—an area with typical rural residential zoning—are no longer highly suitable for the Quino and now support only small numbers (Biological Monitoring Program 2019 p. 14). While the Oak Mountain Core Area is one of the best remaining areas for Quino occupancy, with the remaining open land recognized as "very crucial to Quino persistence," it "continues to be developed," putting this prime location at risk (Biological Monitoring Program 2019 p. 15).

Western Riverside County and Murrieta Hills

Historic Riverside County western populations in the French Valley area, Warm Springs, Temecula, and Murrieta, are either extirpated or in decline. In 2018, 54 total adult Quino were found in only four of the Core Areas, none of which were within the French Valley (Biological Monitoring Program 2019 pp. 7–9) and Quino are considered extirpated from the Warm Springs Creek Core (USFWS 2019 p. 5). Edge effects from surrounding and intermixed development and pervasive non-native grasses that destroy the intact soil conditions needed by Quino larvae also likely make impossible any future Quino reintroduction (see discussion below on restoration feasibility in San Diego). Many highways cross core and satellite habitats in Riverside County and can lead to heavy Quino mortality (Dudek & Associates, Inc. 2003b pp. 1–26). Despite the conjecture that large wildlife overpasses could effectively permit Quino dispersal across busy roads (Dudek & Associates, Inc. 2003b pp. 1–26), the "Quino bridge" constructed over Clinton Keith Road at the behest of FWS is considered by Quino experts to be biologically completely inefficacious (Osborne 2020b).

On February 25, 2020, the U.S. Army Corps of Engineers posted notice of an application for a permit for the Murrieta Hills Development Project (U.S. Army Corps of Engineers 2020). The proposed project would construct 557 single-family residential units, 193 multi-family units and 18 acres of general commercial space within an approximately 973.7-acre area within the southern portion of Menifee Valley in unincorporated Riverside County, California (U.S. Army Corps of Engineers 2020 p. 7). The project site is currently undeveloped (U.S. Army Corps of Engineers 2020). The Corps' notice further indicates that the Quino is present in or around the proposed development, stating: "In total, the proposed project would remove approximately 277.21 acres of potential habitat for Quino checkerspot butterfly consisting of chaparral, coastal sage scrub, Riversidean sage scrub, non-native grassland, coast live oak woodland, and disturbed land cover types" (U.S. Army Corps of Engineers 2020 p. 5). The City of Murrieta issued a Draft Environmental Impact Report (DEIR) for the project on May 8, 2020. The DEIR acknowledges that Quino are "known to occur in [the Project] area" and that the property proposed for development contains Quino host plants and nectar sources (City of Murrieta et al. 2020 p. 4.3-27). Further, the Corps determined that the project "may affect, likely to adversely affect" the Quino and plans to initiate formal consultation with FWS "through a streamlined" process, requesting take authorization under the MSHCP be extended to this project and to the Corps (U.S. Army Corps of Engineers 2020 pp. 6–7). Thus, even if deemed compatible with the

MSHCP Criteria Cell standards, the Murrieta Hills development project may further jeopardize Quino in Riverside County through the effects of incremental habitat loss and fragmentation.

San Diego County

The Quino checkerspot butterfly is experiencing many cumulative and compounding threats from ongoing and imminent development in San Diego County that put it at risk of extinction in its last few Core populations areas. The mitigation thus far obtained by FWS for the destruction of Quino core habitat is insufficient to protect the butterfly from extinction. Importantly, the Quino checkerspot butterfly is not a covered species in the San Diego Multiple Species Conservation Program (MSCP), adopted in 1996 that covers some of Quino's current range. As a result, even in jurisdictions subject to an adopted MSCP NCCP/HCP Subarea Plan (County of San Diego) or which are preparing a subarea plan under the program (e.g. Santee), project impacts to Quino are being addressed through piecemeal, project-by-project permitting under Section 7 or Section 10 of the federal ESA.

Otay Village 14

On June 26, 2019, the County of San Diego approved the Otay Village 14 and Planning Areas 16 & 19 Project ("Village 14") (San Diego County 2020a p. 14; County of San Diego 2020d p. 2). The project site encompasses approximately 1,369 acres in Proctor Valley in unincorporated San Diego County in the Jamul/Dulzura Subregional Plan area (County of San Diego 2019 p. S.0-3). The Project is a planned community consisting of 1,119 single-family residential units, commercial uses, and a "Village Core" connected through a system of new roadways (County of San Diego 2019 p. S.0-2). The Final EIR for the project states that the project would result in the disturbance of 793.7 acres of Quino checkerspot butterfly "potential habitat," (County of San Diego 2018 p. 2.4-81) including at least 488.4 acres of federally designated critical habitat (Dudek & Associates, Inc. 2020a p. 29). Numerous Quino individuals at numerous locations in the immediate vicinity of the project were observed and recorded in 2017, 2018, and 2019, despite the fact that no protocol surveys were conducted in those years (Dudek & Associates, Inc. 2020a p. B-1, B-2).

On June 3, 2020, the County approved a revised "amended" project (County of San Diego 2020d) along with an associated amendment to the MSCP that "covers" the Quino under the MSCP for the amended Village 14 project only. The revised project reflects the exchange of 219 acres of State Ecological Reserve lands in central Proctor Valley that were purchased in 1993 by the Wildlife Conservation Board for "permanent protection" for private lands owned by GDCI Proctor Valley, LP (GDCI) in northern Proctor Valley. The proposed exchange of lands would shift development into the central portion of Proctor Valley from northern Proctor Valley, providing a more financially lucrative development footprint sought by GDCI, with 147, or 13%, more units. The Wildlife Conservation Board will consider the exchange in August of 2020.

The County has acknowledged that the revised project enacting the land exchange would result in a net loss of federally designated critical habitat for Quino compared to the approved project (County of San Diego 2020a p. 11). Indeed, the entirety of Central Proctor Valley where

Ecological Reserve Lands would be converted to development is designated Critical Habitat for the Quino, while northern Proctor Valley (where other lands would be conserved) contains almost no Critical Habitat (Dudek & Associates, Inc. 2020b fig. 2.4-20).

According to Quino biologists, central Proctor Valley is an integral part of the Otay metapopulation and key for connectivity between Otay Mountain and San Miguel Mountain (Osborne & Ballmer 2018). The development area is of critical importance to the continued regional persistence of the butterfly because the land in central Proctor Valley is generally intact, with native understory, bare ground, and cryptobiotic soil crusts important to the Quino (Osborne & Ballmer 2018). In contrast, the northern exchange lands are dominated by thick grasslands (see maps and photos, Hamilton 2020). The exchange lands are not expected to support a significant Quino population according to the California Department of Fish and Wildlife (CDFW) (CDFW 2019); as one indication of the difference in habitat quality, there were 44 observations of Quino in 2017, 2018, and 2019 on CDFW lands alone in Central Proctor Valley yet during the same time period, only six Quino were recorded in northern Proctor Valley (Hamilton & Stallcup 2020).

In sum, the results of the land exchange would be the destruction of hundreds of acres of known, occupied Quino habitat in central Proctor Valley and preservation of other habitat of marginal value to the Quino in northern Proctor Valley. The County did not prepare a subsequent or supplemental environmental impact report under the California Environmental Quality Act (CEQA) for the revised project. Although the the Land Conversion Evaluation (LCE) (CDFW 2019) identifies the need to restore GDCI exchange lands to a state comparable to the existing "highly intact" condition of the CDFW preserve lands, it never acknowledges that large-scale restoration of grassy and weedy areas to a "highly intact" (Quino-quality) condition is likely impossible, making the project's proposed mitigation inadequate. As stated in the letter dated May 25th, 2020, prepared by Quino experts Greg Ballmer and Ken Osborne (Ballmer & Osborne 2020a p. 5):

> The soil conditions that have precluded exotic weed invasion and that promote springtime longevity of *Plantago* require special compositions and decades or centuries of non-disturbance. In our experience, they cannot be recreated simply by weeding efforts. The proposed weeding of disturbed areas in the Village 14 "Quino Checkerspot Butterfly Conservation Strategy" is woefully inadequate to mitigate for lost Quino-quality *Plantago erecta* habitat that uniquely developed over ecological time.

Indeed, based on a review of all available monitoring reports of enhancement/restoration projects to date, no evidence exists that restoration efforts on such disturbed lands will be effective in sustaining Quino occupancy (AECOM 2010, 2013, 2015, 2016, 2017; Osborne 2013, 2014, 2015, 2016, 2017; Caltrans 2018; RECON Environmental, Inc. 2018, 2019; San Diego Habitat Conservancy 2019; HELIX Environmental Planning, Inc. 2019). These efforts involve weeding, host plant seeding, and a case of larvae reintroduction (which is not proposed here). The reports document no sustained increase of carrying capacity beyond baseline levels or the establishment of self-sustaining Quino populations where none existed before. The proposed management measures therefore have no track record of efficacy. Even if the restoration were to overcome the soil condition obstacles described above, it would fail as mitigation because 1. its scale of several acres is a "drop in the bucket" compared to the impact of close to 200 acres, and 2. it would not recreate the range of microenvironments lost in the broad impact area, the diversity of which is essential for a viable metapopulation. There is no possibility of the exchange not resulting in a major net loss of occupied Quino habitat.

In conclusion, the Village 14 project in any of its iterations, including the land exchange, poses an imminent threat to the Otay population though loss of prime habitat in a location valuable for regional connectivity and the pernicious effects of development and fragmentation upon previously viable populations. In developing the mitigation plan for Quino that unsoundly relies on restoration, the applicant coordinated primarily with FWS rather than CDFW, reflecting CDFW's lack of regulatory authority (USFWS et al. 2020; Howard 2020).

Otay Village 13

A major development known as Otay Village 13 is planned to obliterate a large portion of the most reliable and productive Quino population known in San Diego. In March 2020, the County of San Diego published a Final EIR for the Otay Ranch Resort Village - Village 13 Project (San Diego County 2020b; County of San Diego 2020b). The proposed Project site consists of approximately 1,869 acres located on Otay Lakes Road in southwestern San Diego County, east of Chula Vista (County of San Diego 2020b p. S-1). The project is a portion of Otay Ranch, which like Village 14 is also covered by the 1993 Program EIR that requires avoidance of occupied Quino habitat. Village 13 proposes development of 1,881 single-family dwelling units, a mixed-use area with 57 multi-family residences and up to 20,000 square feet of neighborhood commercial uses, and a 17.4-acre resort hotel that would consist of up to 200 guest rooms and up to 20,000 square feet of ancillary commercial/office uses, including meeting rooms, a conference center, offices, shops, and restaurants.

The Village 13 Final EIR for the project discloses that 145 individual Quino checkerspot butterflies were recorded in surveys conducted in the past five years on the project site, and many of the sighting locations were within the development footprint of the project (County of San Diego 2020c p. 2.3-19). The project site would affect over 573 acres of federally designated critical habitat within Unit 8 (County of San Diego 2020c p. 2.3-20). The focus on mere numbers of host plants and adults in the Final EIR completely ignores the effect of the development on the site's current known function as a dependable source population. The loss of Core habitat from the project (even after proposed mitigation) will have a significant and potentially catastrophic effect on the long-term viability of the affected Unit 8 metapopulation.

By reducing the size of a large area of designated Quino critical core habitat, Village 13 will prevent Quino larvae from finding enough food to survive pre- and post-diapause and from successfully moving about the landscape to required areas of microhabitat for pupation, resulting in significant negative impact to butterfly's survival in the region. Quino larvae require heterogeneous habitat of sunny southern facing slopes with shaded areas and both open areas with food plants and nearby areas with larger vegetation (Osborne & Redak 2000; Pratt & Emmel 2010). For a large Quino population to persist on a given site for many years and achieve population occupancy, the butterfly needs an expansive, connected heterogeneous area of habitat (Osborne & Redak 2000). Should it be allowed to proceed, Village 13 would break up the existing continuous expanse of habitat, reducing if not dooming the resiliency of this metapopulation. Also, Village 13 is located directly adjacent to Otay Lakes; proximity to moisture-laden waterbodies has been recognized as important to population resilience, yet such unique habitat is exactly what would be lost at Village13. (USFWS 2019 p. 4).

The Final EIR's proposal to mitigate the loss of an occupied core Quino checkerspot butterfly habitat at a 2:1 ratio largely on-site will not reduce the impacts from this project to less than significant (County of San Diego 2020c p. 2.3-20). The remaining on-site habitat will be seriously degraded as a result of edge effects, invasive species, fragmentation, and human disturbance. Given the well documented effects of nearby incremental development on Quino populations (Preston et al. 2012) there is no reason to believe that the undeveloped habitat will ensure that the affected metapopulation will be able to survive in the long term and continue to function as a source for temporarily depopulated locations. The Village 13 site has proven resilient during prolonged drought, with positive surveys when nearby locations were negative, and all proposed alternatives, including the their favored 'Alternative H' plan, are no substitute for protection of this unique source population and the diverse microclimes that confer resiliency. According to Greg Ballmer and Ken Osborne (2020b):

> The project's vast development footprint would remove 692 acres of Quino habitat, *all* of which is Critical Habitat for the species as determined by the US Fish and Wildlife Service. …Alternative H will eliminate substantial site diversity – in slope, aspect, soil, vegetation, etc. – and, contrary to unsupported claims in the FEIR, will have *devastating* effects on a known and reliable Quino source population.
>
> According to the FEIR, the development footprint of Alternative H directly displaces about 40% of reported QCB larval host plant sites within the overall project site. The documents point out that some of the densest occurrences of QCB larval host plants would be conserved within proposed open space… In contrast to the EIR's assumptions, it is precisely dispersed (*not* densely concentrated) larval resources in a diversity of microclimate settings that support the resilience of QCB populations through climate fluctuations and other stochastic events.
>
> All QCB resources within the proposed Alternative H development footprint would be eliminated. Additionally, based on the 1 km rule (Preston, et al 2012), essentially all observed QCB adult and larval host plant sites within the proposed preserved open space, and extending into adjacent lands managed by other entities, would be at risk of extirpation. Insofar as the QCB population within the Project site and adjacent properties is integral to the

> larger Proctor Valley QCB metapopulation complex, Alternative H constitutes an existential threat to the Proctor Valley QCB metapopulation complex…
>
> As mitigation for Alternative H, the County proposes to set aside occupied Quino habitat on-site in proximity to the development area and to undertake a very limited program of host plant restoration/enhancement in currently weedy patches in the conservation area. The proposed measures would fail to mitigate for the project's impacts to the Quino for two reasons. **First, the proposed mitigation would *not* compensate for the diverse microenvironmental range lost in the broad area impacted by the project, the diversity of which is essential for a viable metapopulation. At best it would produce marginally more host plants in the exact same fewer microenvironmental locations that already exist within the proposed covered space, and therefore perpetrate a great loss of the original diversity of microenvironments…**
>
> **The second reason for failure of the mitigation plan is that the restoration/enhancement *itself* has a low likelihood of efficacy, and indeed, no evidentiary support in providing actual benefit to the Quino**. Even if successful, rehabilitating a *very small* amount of degraded QCB habitat on site cannot mitigate for the loss of *many times* that amount of mature, diverse, occupied habitat within the project impact area

Otay Quarry

This mining project located on Otay Mountain in southern San Diego County is pursuing consistency with the San Diego County MSCP Subarea Plan and an HCP permit from USFWS (HELIX Environmental Planning, Inc. 2020a). Based on the protocol for identifying occupied Quino habitat in the 2009 draft Quino Amendment to the MSCP, 410.7 of the 414.4 acres of the site and off-site parcel are considered occupied, respectively, and implementation of the proposed project would impact 104.9 acres of occupied Quino habitat with a loss of 97.8 acres of Critical Habitat (HELIX Environmental Planning, Inc. 2020b p. 4.3-9,10).

Otay Mesa Project Southwest Village Specific Plan

On February 26, 2020, the City of San Diego issued a Notice of Preparation of an EIR for the Otay Mesa Southwest Village Specific Plan project (The City of San Diego 2020). The project site is 490 acres, located approximately seven miles west of the coast and 0.5 miles north of the Mexican border (The City of San Diego 2020). The proposed project would allow up to 5,130 attached and detached residences, and new "village" anchored by up to 175,000 square feet of commercial and retail uses in a mixed-use Village Core (The City of San Diego 2020). Although the EIR has not yet been prepared and surveys, if conducted, have not been made public, CDFW submitted comments on the project noting that Quino is among the special-status species for which the project could have significant impacts (Mayer 2020 p. 2).

Fanita Ranch

The City of Santee issued a Notice of Preparation of a Draft Revised Environmental Impact Report for the Fanita Ranch project in 2018, and a draft EIR was circulated in May 2020. The proposed project is the latest iteration of development proposed for the approximately 2,635-acre Fanita Ranch site located on the northern edge of Santee. This version of the project would consist of up to 3,008 residential units (City of Santee 2018 p. 2). The Fanita Ranch site is considered a key component of Quino conservation and recovery due to the presence of 1,700 acres of suitable Quino habitat, including host plants, and its spatial relationship to other populations; the project currently under review would impact about 580 acres of potential Quino habitat and fragment the remainder (Technology Associates International Corporation 2006 pp. 4-57-4–59; Harris & Associates & City of Santee 2020 p. 4.3-63). Commenting on a version of the project substantially similar to that described in the Notice of Preparation, FWS and CDFW (Goebel & Sevrens 2016 p. 15) observed that

> The proposed Fanita Ranch footprint would directly and indirectly impact most of the remaining habitat for Quino (mapped by host plant occurrences) within the project site, including fragmenting what would be the largest remaining habitat patch within the project site. The largest area of extant mapped Quino habitat onsite would, following project implementation, be located between two closely adjacent development polygons; these proposed adjacent development areas would include a community farm and orchard as well as urban development, and two surrounding paved access roads.

Quino surveys were conducted on the Fanita Ranch site in 2004, 2005, and 2016, and an individual Quino was observed on the site in 2005. Although Quino were not detected on the site in 2016, FWS and CDFW consider that drought conditions over the past several years "have created unfavorable conditions for Quino and negatively affected Quino populations in San Diego County," and "expect that Quino are in low numbers on site or the site is currently temporarily unoccupied" (Goebel & Sevrens 2016 p. 15).

FWS and CDFW further observed (Goebel & Sevrens 2016 pp. 15–16) that Fanita Ranch is within the possible future Central San Diego County recovery unit described in the Quino Recovery Plan:

> The unit location described includes Fanita Ranch, and this general area is expected to be the only suitable location in the coastal metapopulation's distribution available and expected to support the species. Loss of the Quino habitat, per the current proposal on the Fanita Ranch site, may preclude recovery of the species. Moreover, based on the current declining status of the species, Quino habitat on Fanita Ranch should be conserved to provide for the Quino metapopulation in the area. As noted above, Quino requires conservation of temporarily unoccupied patches of habitat essential to maintain population resilience (Service 2009). The edge effects and habitat fragmentation that would likely result from the proposed

development would eliminate or considerably reduce the long-term viability of the Quino in the project area and limit the species ability to expand or re-populate the area locally.

FWS and CDFW concluded that "the Fanita Ranch proposed project would not fully minimize and mitigate its impacts on Quino, would result in a net loss of Quino habitat function, and would have a high potential to preclude recovery of the species" (Goebel & Sevrens 2016 p. 16).

Habitat Fragmentation

Quino metapopulations require connectivity between its subpopulations for survival and are vulnerable to the permanent loss of any subpopulation that reduces stepping stone connectivity or dispersal patterns (Mattoni et al. 1997 p. 114). Historically, isolation of Quino populations has been associated with extinction, as 92% of extant populations had another population within five km compared to just 8% of extinct sites (Preston et al. 2012 p. 284). The only appropriate protective approach for the Quino is to maintain large continuous parcels of land that contain all Quino metapopulations (Mattoni et al. 1997 p. 115). Unfortunately, even as it is federally protected as endangered with designated critical habitat, the Quino has and continues to lose large swaths of its core habitat areas, due to actions like those described above, reducing essential connectivity.

For a large Quino checkerspot butterfly population to persist on a given site for many years and achieve population occupancy, the butterfly needs an expansive, connected heterogeneous area of habitat (Osborne & Redak 2000). Turning a large area of designated critical core habitat for the Quino checkerspot butterfly into fragmented areas of smaller disturbed areas, such as proposed in the Otay Village 13 and 14 projects, will prevent Quino larvae from finding enough food to survive pre- and post-diapause and from successfully moving about the landscape to required areas of microhabitat for pupation, resulting in a significant negative impact to the butterfly's survival in the region. Should all of the currently proposed (and permitted) development projects be allowed to proceed, they would break up the continuous expanse of habitat, cumulatively causing Quino extinction (Whitehead et al. 2017).

Specifically, once the butterfly emerges from the chrysalis, adult females must mate and lay eggs as well as seek nectar plants for feeding. Habitat fragmentation from the many current and imminent development projects outlined above would result in less contiguous habitat, causing separation of larval host plants from potential nectar sources, reducing the resources available to adult butterflies. This translates to female adult butterflies unable to obtain enough nearby nectar resources between bouts of egg laying, reducing energy levels and fecundity, thus significantly harming the butterfly by reducing reproductive output (Mattoni et al. 1997 p. 106).

While the reproductive success of dispersing Quino adults depends on them finding suitable scattered resources, they can be inhibited from doing so by effective barriers such as high walls (probably in excess of ten feet high), extensive patches of housing and development, and large highways (Osborne & Ballmer 2019 p. 6). Adult Quino dispersing into inappropriate habitat (such as built environments) are lost to the metapopulation. Thus, placement of extensive areas of development within Quino metapopulations, as is outlined above, create barriers to dispersal and remove Quino adults from the functional population. While Quino corridors have been discussed and attempted, experts believe that (Osborne & Ballmer 2019 p. 6):

> Setting aside dispersal corridors (through a built environment) is a problematic attempt to maintain connectivity within the larger metapopulation and assumes the unlikely ability of dispersing Quino to recognize and remain within such corridors without wandering into the "dead zone" of adjacent urban landscapes. For designated dispersal "corridors" to be effective, they must be buffered sufficiently from bordering urban landscapes. While the effective dimensions of such corridors have not been experimentally determined, a minimum width is likely to be at least as great as that for an edge effect buffer (i.e. 0.6-mile buffer from each edge).

The Quino is also negatively impacted by the synergistic threats of habitat fragmentation, invasive species, and climate change (USFWS 2009b). Habitat patches with large edge-to-area ratios also experience higher rates of invasive plants due to ground disturbance and edge effects (USFWS 2009b p. 15). Butterflies are unable to recolonize fragmented habitat patches once isolated from the metapopulation (Preston et al. 2012); thus, without interbreeding between patches, the butterfly will have limited behavioral and genetic adaptive capacity and be further compromised in the area. Further, all recent science on Quino conclude that maintaining connectivity among habitat and to higher elevation habitat is necessary for Quino's adaptation and survival in the face of climate change (USFWS 2019 p. 3). As such, maintenance of functional connectivity between contiguous core habitat and suitable habitat patches is a necessary conservation action to minimize the loss of the butterfly in the face of increasing human population growth and development and the changing climate.

Loss of Genetic Diversity

The lack of connectivity between populations results in lower gene flow between metapopulations and ultimately inbreeding depression (the increased incidence of mating among relatives leading to an increase in homozygosity of deleterious alleles), lower effective population size, loss of genetic diversity, and subsequent extinction (Nieminen et al. 2001 p. 237; Miller et al. 2014). Inbreeding depression occurs in small populations with no gene flow and is a major threat to population viability (Nieminen et al. 2001 pp. 240–243). While Quino's current genetic diversity has not been compared to historic levels, due to the extreme reduction in population abundances and connectivity, it is likely that genetic diversity of current wild populations is low relative to historical levels (Miller et al. 2014 p. 86). Inbreeding depression was found to increase the extirpation probability of a related, similar butterfly species, the Glanville fritillary, which is also found in isolated metapopulations (Nieminen et al. 2001 pp. 242–243). Continued habitat fragmentation and population isolation could lead to poor genetic health, reduced fitness (e.g. genetic disorders, susceptibility to disease), and reduced resilience to stochastic events (e.g. flooding, wildfire) and climate change.

Border Wall

On Jan. 25, 2017, Donald Trump issued an executive order calling for construction of a wall along the entirety of the nearly 2,000-mile border between the United States and Mexico. Since January 2017, 139 miles of new primary and secondary border wall system has been constructed along the U.S. southern border in addition to the already nearly 700 miles of barriers (U.S. Customs and Border Protection 2020a p. 1). In 2017, approximately 40 miles of new border wall system was built in San Diego and El Centro Sectors of California; construction of 12 more miles of new wall in San Diego began in 2019 and more are planned for 2020 (U.S. Customs and Border Protection 2020a pp. 1–2). The Department of Homeland Security describes the new wall system as follows: "The projects also include the installation of a linear ground detection system, road construction or refurbishment, and the installation of lighting, which will be supported by grid power and include embedded cameras. The design of the new bollard steel fencing includes 30-foot steel bollards that are approximately 6" x 6" in diameter" (U.S. Customs and Border Protection 2020b p. 1).

The wall itself creates an impassable barrier to wildlife; it results in thousands of acres of direct habitat destruction, impacts thousands more through indirect disturbance from roads, lights, noise, serves as a barrier to movement of plants and animals, and causes soil erosion, altered fire regimes and hydrological processes (Peters et al. 2018 p. 740). Impacts of existing border construction on wildlife or the environment as a whole have not been catalogued in large part because Congress, under the Real ID Act in 2005, has vested the Homeland Security secretary with the power to waive otherwise applicable laws, including the ESA and NEPA (Peters et al. 2018 p. 740).

Of the Quino's 62,174.2 acres of critical habitat, 40,133.5 acres, or 64.6%, lay within 50 miles of the border (Greenwald et al. 2017 pp. 11, 16). Quino critical habitat has already been hit hard by wall construction, with border wall prototypes having been built within Quino critical habitat (Hamblin 2018). Now more damage is occurring as a double-layer border wall is being built across the western edge of the Otay mountains within Quino critical habitat, resulting in habitat disturbance and cleared land to add the secondary barrier and patrol roads (U.S. Customs and Border Protection 2018 p. 3).

A map created by the Center for Biological Diversity (Figure 8), shows designated critical habitat for the Quino to the east of the existing border wall prototype site and where the Customs and Border Patrol (CBP) is constructing 14 miles of wall and associate infrastructure (U.S. Customs and Border Protection 2018). CBP's 2018 Biological Survey of this area notes that "the Quino checkerspot butterfly has a moderate to high potential to occur within the Project Area" and that "there is suitable habitat for the Quino checkerspot butterfly within the Project Area" (U.S. Customs and Border Protection 2018 pp. 25, C–4).

The proposed 30-foot high "secondary wall" will further interfere with migrations and flight patterns of the Quino checkerspot butterfly, which generally avoids flying over objects taller than seven to eight feet (USFWS 2009b; Greenwald et al. 2017 p. 16; Peters et al. 2018 p. 741). Even though there are gaps between bollards in a bollard-style wall, the proposed wall, especially when considered cumulatively with the impacts of the existing 18-foot high “primary wall” and other infrastructure in the area, is likely to interfere with flight patterns and increase genetic isolation between the small U.S. population of butterflies and the larger population in Mexico (Stallcup 2004 p. 2). With the immense amount of ground disturbance, border wall construction also harms native vegetation and spread invasive species, threatening the host plants the butterfly needs to reproduce. Because the butterfly has declined so drastically, the size and connectivity of all surviving populations are critically important to avoid inbreeding depression and to contribute to adaptive resilience in the face of climate change.

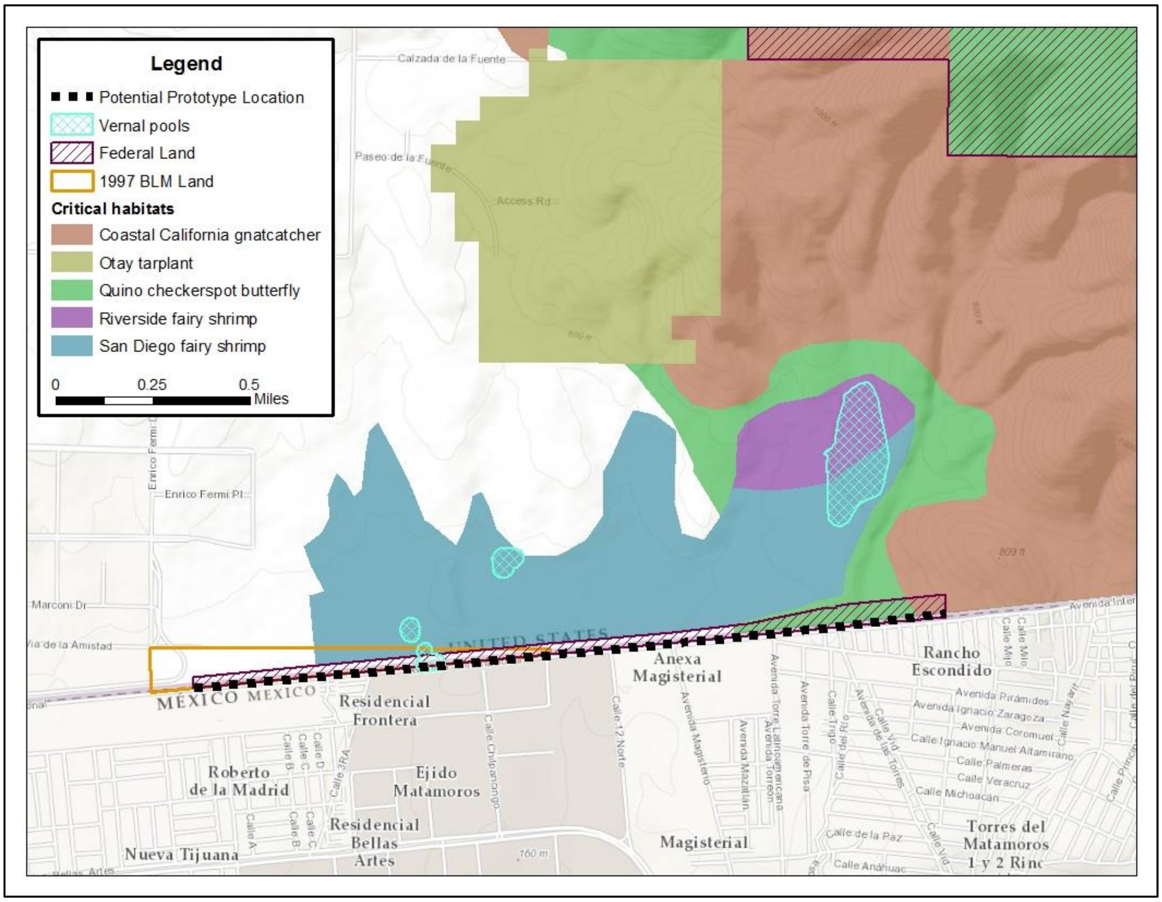

Figure 8. Critical habitat map at proposed wall construction in San Diego County, Quino shown in green. Map by Kara Clauser.

Invasive Species

According to the USFWS, the “Conversion from native vegetation to nonnative annual grassland is the greatest threat to conserved habitat and a high magnitude threat to all habitat that is not managed” (USFWS 2009b p. 15). Invasive plants outcompete and thus reduce the abundance of Quino host and nectar plants (USFWS 2003 pp. 57–58). Invasive plants also reduce the suitability of Quino host plants, as females are less likely to deposit eggs on host plants that are shaded by other plants (USFWS 2003 pp. 57–58, 2009b p. 15). Unfortunately, nearly all of the Quino’s former range has been converted into a landscape dominated by human habitation or non-native plant species (Biological Monitoring Program 2019 p. 2). At the time of the FWS's Quino five year review, "no plans or actions to control nonnative plant species are currently in place" in places where the threat of grazing has been reduced (USFWS 2009b p. 16).

The majority of the invasive plants threatening the Quino were introduced as forage for livestock, particularly Mediterranean grasses and forbs, that rapidly outcompeted and replaced most native grassland vegetation; thus, Quino host plants have been and continue to be severely reduced in population size and extent (Seabloom et al. 2003 pp. 575–576; Biological Monitoring Program 2019 p. 2). Nonnative annual grasses such as red brome (*Bromus rubens*), rigput brome (*B. diandrus*), and slender wild oat (*Avena barbata*) have spread from coastal to inland habitats, contributing to the rapid loss of Quino habitat and its decline (Preston et al. 2012 p. 288). According to Ballmer and Osborne (2020a p. 2), "Generally, all of the significant, lowland *Plantago erecta*-associated Quino populations occur on soil conditions that both support the butterfly hostplant ***and exclude competitive exotic annual plants.***"

Nitrogen Deposition

Soils in urbanized regions are being fertilized by excess nitrogen generated by human activities, an intensifying threat as more roads are constructed with increased urbanization, such as is planned in the Southern California Association of Government's long-range Regional Transportation Plan (USFWS 2003 p. 65; Weiss & Longcore 2020 p. 1). Specifically, nitrogen pollution from urban traffic produces nitrogen oxides and ammonia that increases soil fertility and in turn stimulate growth and dominance of nutrient-limited nonnative, invasive grasses, exacerbating their competitive advantage and the displacement of Quino host plants, like *P. erecta* (Padgett et al. 1999 p. 769; Weiss 1999; Fenn et al. 2010; Weiss & Longcore 2020). The continued urban sprawl being proposed and permitted currently in Quino's core and critical habitat areas will add to the nitrogen pollution and invasive species dominance.

Quino occurs in the fastest growing and spreading counties where even 20 years ago, soils in the most polluted regions near Riverside, California had more than four times the typical concentration of extractable nitrogen than found in unpolluted soils (Padgett et al. 1999; USFWS 2009b p. 15). Still today southern California has some of the highest nitrogen deposition in the United States, can exceed 25 kg-N ha^{-1} $year^{-1}$, and local hotspots can exceed 50 kg-N ha^{-1} $year^{-1}$ (pre-industrial background is estimated at < 1 kg-N ha^{-1} $year^{-1}$) (Weiss & Longcore 2020 pp. 2–3). Nonnative grass invasion is facilitated at 6 kg N ha^{-1} y^{-1} and 7.8–10 kg N ha^{-1} y^{-1} of deposition in native grasslands and coastal sage scrub, respectively; further, elevated nitrogen can spread and be deposited at least 1,500 feet from the roadway (Weiss 1999; Fenn et al. 2010; Weiss & Longcore 2020 pp. 2–5). In addition to the regional plume of nitrogen pollution, the long-range Regional Transportation Plan includes the widening of highway 79 within 1.5 miles Quino's critical habitat at Skinner Reservoir and the widening of I-15 adjacent to the Northwest Riverside recovery unit (Weiss & Longcore 2020 p. 6). Thus, nitrogen deposition is a major threat to the Quino and poses to become a larger threat due to sprawl development planned throughout its range.

Cannabis cultivation

New and existing agricultural operations are largely exempt, and thus require no mitigation, under the Western Riverside MSHCP (Dudek & Associates, Inc. 2003a pp. 6–56). Since the MSHCP adoption in 2003, smaller and more scattered operations have emerged as the agricultural economy has adapted to changing markets. A potential increasing threat to Quino and its habitat is cultivation of marijuana via direct effects of habitat destruction, introduction of pesticides and chemical fertilizers, and illegal and legal water extraction that exacerbates drought (Bauer et al. 2015; Carah et al. 2015). As Quino expert Gordon Pratt notes regarding the Anza population in Riverside, County (Pratt 2020a):

> The Anza populations are still here, although they have suffered drastically from a variety of things. One of the major problems is caused by local marijuana growing. Pesticides, herbicides, fertilizers, etc. put into the habitat where Quino occur have taken their toll upon local populations. Converting land use for marijuana growing on even Federal lands set aside in part for Quino such as with the Beauty Mountain Wilderness seems to have caused drastic reductions in populations. Less than 10 years back I could walk local drainages and literally see hundreds of Quino, now I can walk the same drainages and consider myself lucky to see one Quino.

Livestock Grazing

While light conservation-based grazing may maintain early successional habitat needed by the Quino, heavy grazing reduces the cover of Quino host plants in favor of invasive species, such as *Erodium botrys*, as *P. erecta* has been found to be more common in areas inaccessible to cattle (Mattoni et al. 1997 p. 113). As noted by a Quino expert, "even though grazing temporarily removes the annual crop of exotic weeds, it also disturbs the soil surface thus promoting the continued dominance of the same weeds. The promotion of grazing for Quino conservation overlooks this critical flaw- the unavoidable maintenance of soil surface disturbance as part of an unending feedback cycle" (Osborne 2020a). Grazing can directly trample and kill diapausing larvae and pupae, alter microclimates, and reduce the richness and abundance of host and nectar plants (USFWS 2003 pp. 59–60; Preston et al. 2012 pp. 285–288). Of critical importance due to Quino's extended diapause phase, soil surface stability is decreased and soil compaction increased by grazing (Kimoto et al. 2012 p. 7). Further, grazing disturbs and eliminates the important cryptogamic crusts that maintain soil stability and hold in essential moisture and nutrients (Mattoni et al. 1997 p. 112).

Recreation

Recreational activities such as biking, off road vehicle (ORV) use, and equestrian activities, are expected to increase with sprawl development projects outlined above and will be detrimental to Quino when adults and larvae are active, as larvae frequently bask in open areas and on bare ground, such as ORV tracks (Osborne & Ballmer 2019 p. 5). Frequent ORV use increases erosion and fire frequency, and creates trails that are conduits of nonnative plant invasion (USFWS 2003 p. 59) but compaction and damage of arid soil can occur with as few as 1-10 passes by an ORV, leading to water runoff and alteration of the soil biotic community (Lei 2009 p. 159). Loss of cryptogamic crusts due to ORVs also reduces water retention, nutrient retention, and seedling germination (The Nature Conservancy 2007 pp. 52 and 58). ORV tracks, even single passes, can also facilitate the spread of invasive plants by creating areas that trap and shelter seeds (Brooks 2009 pp. 112–113). Large increases in nonnative plant biomass and species richness has been found within ORV tracks and areas with increased ORV track density, respectively (Brooks 2009 p. 116). ORVs also expel significant amounts of fine and coarse dust particles (Goossens & Buck 2009 pp. 118, 134) that can cause insect mortality by increased desiccation due to cuticle abrasion and excessive salivary grooming, respiratory stress by blocking spiracles, and disruption of digestion if ingested (Edwards & Schwartz 1981 p. 715).

The FWS has recognized that "recreational disturbance is frequently observed in monitored, occupied habitat where larvae are observed on host plants" (USFWS 2009b pp. 14–15). While Quino requires some disturbance to maintain its host plants, ORV trails can become ecological traps as habitat for Quino females to lay eggs on host plants adjacent to the trail and for post-diapause larvae to bask in the sun (Schlaepfer et al. 2002; Ballmer 2020). Specifically, ORVs push *P. erecta* host plant seeds 1-2 inches into the soil along trails, resulting in plants that grow larger than other *Plantago* spp. since the seeds remain moister for longer into the season; these large host plants attract Quino females since they prefer to lay their eggs upon large plants on open soil and larvae subsequently build communal shelters along the roads, attracted to the sun exposure (Pratt 2020c). Thus, the ORV trails become preferred habitat for Quino eggs, larvae, and adults that are then crushed when ORVs come back over the trails, an effect witnessed on Bureau of Land Management (BLM) properties in Wilson Valley, Riverside County in the late 1990s (Pratt 2020c). Thus, temporally and/or spatially extensive ORV use can be and has been extremely detrimental to Quino populations, aiding in the extirpation of at least two sites (Ballmer 2020).

Quino experts have witnessed numerous dead, squashed Quino larvae on an informal ORV trail shortly before, in subsequent seasons, the Harford Springs, Riverside County Quino colony had declined or disappeared (Ballmer 2020). That colony was well known for many years by lepidopterists prior to its extirpation, which occurred during a period of conversion of surrounding open space to semi-urban development (large lot homes of five or more acres) whose owners partook their equestrians and ORV recreational activities in the remaining open space surrounding the county park (Ballmer 2020). The Riverside County Oak Mountain/Vail Lake Quino Core site (the most significant remaining *P. erecta* associated Quino colony remaining in the county) is a patchwork of private and BLM lands with informal ORV trails throughout and has been regularly degraded by ORV activity (Figure 9), despite BLM signage prohibiting this use (Ballmer 2020; Osborne 2020a).

Figure 9. Off road vehicle tracks at Riverside County Oak Mountain/Vail Lake core site (Photo by Greg Ballmer).

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization pushes imperiled species towards extinction, especially in conjunction with other threats. At the time of federal listing, over-collection was considered a potential threat to Quino because of specimen value to collectors (USFWS 1997). Thus, the Quino is likely still imperiled by insect collectors who highly prize specimens of this subspecies due to its rarity and notoriety (C.D. Nagano pers. comm.). Like many other rare and imperiled butterflies, there are national and international markets for protected and petitioned species. For example, populations of the endangered Mitchell's satyr butterfly were visited on an almost daily basis by collectors who captured every specimen they could find and after a few seasons, they vanished (Gochfeld & Burger 1997). The collector who discovered the endangered Saint Francis satyr butterfly would not disclose its location and told others the animal was extinct to increase its commercial value (C.D. Nagano pers. comm.). Two collectors who later plead guilty to violating the Endangered Species Act had large numbers of nearly all the listed butterflies in the United States, including the Quino (US Attorney's Office 1993). There are now numerous dealers on the internet who sell a wide diversity of common, rare, imperiled, and protected butterflies on their own websites, eBay, and Facebook for up to thousands of dollars depending on the species and the quality of the specimen. Thus, commercial transactions have become easier and are often carried out with no public scrutiny via direct email between dealers and known customers.

Although there are no studies of the impact of the removal of individuals on natural populations of the Quino, studies of other imperiled and endangered nymphalid butterflies (Gall 1984a, 1984b; Hellmann et al. 2004), and a Lycaenid butterfly (Duffey 1968) indicate that it is highly likely that the Quino would be adversely affected if collected during low periods in their metapopulation cycle when colonies are small and isolated from each other. As has been observed by FWS law enforcement personnel, collectors are known to take large numbers of specimens of rare butterflies in anticipation of rising value when the species is at low populations or if they become extinct (C.D. Nagano pers. comm.). An added threat to the Quino is when collectors trample, compact, and destroy eggs, larvae, pupae and the sensitive cryptogrammic soils that are a key element of the early stage habitat. Concern about this impact caused the FWS to require permits for biologists surveying for the subspecies (C.D. Nagano, pers. comm.). The listing of the Quino as endangered by the State of California would give added critical protection from collectors.

Other Natural or Manmade Factors Affecting its Continued Existence

Climate Change

Human activities have increased global average temperatures 0.8-1.2°C above pre-industrial levels with a trend of about 0.2°C per decade due to past and current emissions (Intergovernmental Panel on Climate Change 2018 p. 4). At current emissions rates, global temperatures will increase by 1.5°C between 2030-2052, resulting in increased incidence of severe weather events (Intergovernmental Panel on Climate Change 2018 p. 4,8). At a warming of 1.5°C, temperature and precipitation extremes will be exacerbated (Intergovernmental Panel on Climate Change 2018 pp. 8–9). The Quino's range in southern California has been and will continue to experience more precipitation extremes between heavy rainfall and extreme drought as well as increased annual mean temperatures and warmer nights (Parmesan et al. 2015 pp. 14–15). Quino population extinction is associated with a higher proportion of extreme rainfall events during 10-20 year periods and remaining Quino populations are found in areas with less precipitation extremes and lower temperatures (Preston et al. 2012 pp. 284–288).

Extended drought has been more common in Southern California since 2012 and has resulted in lower adult numbers across the Quino's range compared to years past (USFWS 2019 p. 3). Further, the remaining largest and most resilient Quino populations are associated with water bodies, particularly large and long-established reservoirs such as Lake Skinner, Vail Lake, and Lower Otay Lake, most likely due to the available moisture during times of drought (USFWS 2019 p. 4). Due to the reduction of cooler, high humidity coastal habitat due to development, it is essential that metapopulations near water bodies are conserved as they will likely contribute to the Quino's resilience to climate change (USFWS 2019 p. 4).

While other members of the Edith's checkerspot species have been documented to shift their ranges to higher latitudes and altitudes in response to regional warming, the Quino lives at the southernmost range limit of the group, making it particularly vulnerable to climate warming (Parmesan et al. 2015 p. 3). The Quino is currently extirpated from its historical northern range limit but is precluded from re-colonizing the area without assisted migration due to urban development (Parmesan et al. 2015 pp. 3, 16). Range projections using climate models show zero overlaps between current and future range due to climate change (Parmesan et al. 2015 p. 15); however, Quino populations discovered since 2010 have been found at higher elevations and outside of the designated critical habitat areas, thus the Quino needs protection in these new habitats to allow for adaption and survival in the face of climate change (Parmesan et al. 2015 p. 14). Key to Quino survival in the face of climate change is connectivity between currently occupied sites and those at higher elevations (Parmesan et al. 2015 p. 17).

Increased fire frequency

Climate change is likely responsible for the increased fire frequency in southern California due to drying fuels, a trend that is likely to continue with further warming and declines in precipitation (Williams et al. 2019). Further, sprawl developments, like those planned in Quino habitat, lead to more frequent wildfires caused by human ignitions like power lines, arson, improperly disposed cigarette butts, debris burning, fireworks, campfires, or sparks from cars or equipment (Keeley et al. 1999; Keeley & Fotheringham 2003; Syphard et al. 2007, 2012, 2019; Bistinas et al. 2013; Balch et al. 2017; Keeley & Syphard 2018; Radeloff et al. 2018). The Quino's habitat of chaparral and sage scrub is adapted to large fires being infrequent (every 30 to 150 years) and if these regimes are disrupted, the habitat becomes degraded (Keeley 2005, 2006). When fires occur too frequently, native shrublands are replaced by non-native grasses and forbs that burn more frequently and more easily, ultimately eliminating native habitats and biodiversity while increasing fire threat over time (Keeley 2005, 2006; Syphard et al. 2009; Safford & Van de Water 2014). Thus, as climate change worsens and development is permitted, the resulting increased fire frequency will be detrimental to the Quino and its habitat.

Phenological mismatch

The life cycle of Quino is closely tied to the phenology of its host plants; pre- and post-diapause larval development and adult oviposition must precede host plant senescence (Osborne & Redak 2000 p. 114). Host plant senescence is determined by solar insolation and total precipitation as well as timing of winter and spring rains which are expected to be more extreme (Osborne & Redak 2000 p. 114; Parmesan et al. 2015 pp. 14–15). Quino larvae break diapause synchronously with germination of their annual hosts in response to precipitation in winter; rainfall which occurs during other seasons is of little or no benefit to diapause larvae (Osborne & Ballmer 2019 p. 3). If host plants senesce before the larvae feed and develop enough to enter diapause, many could starve and suffer high levels of mortality and loss of populations, which has been shown in other subspecies of the Edith's checkerspot butterfly group (Parmesan et al. 2015 pp. 2–3). Increased temperatures also cause accelerated host plant senescence at a rate faster than the impact to larval development, causing further phenological mismatch, starvation, and extinction of populations (Parmesan et al. 2015 pp. 14–15).

Disease or Predation

Disease and predation were unknown threats at the time of the FWS's last five year review of Quino (USFWS 2009b p. 16) and it is still unknown if disease or predation are significant sources of threat to the survival and recovery of the Quino checkerspot butterfly.

The Inadequacy of Existing Regulatory Mechanisms and Impact of Existing Management Efforts

The existing regulatory mechanisms are inadequate for preventing the Quino checkerspot butterfly from extinction. Specifically, as described below, the USFWS has not adequately protected the Quino through the implemented habitat conservation plans, critical habitat designation, nor the recovery plan. Due to imminent development projects, the Quino is even more threatened with extinction than at the time of listing.

The same threats impacting Quino at listing, when the 2003 recovery plan was published, and when the 2009 five year review was published were still significantly negatively impacting the Quino (USFWS 2009b p. 13) and continue to do so today despite formal federal protection and in fact, as discussed below, are in many cases worse than before. Those threats include "loss and fragmentation of habitat and landscape connectivity, invasion by nonnative plants, off-road vehicle activity, enhanced soil nitrogen, and increased atmospheric carbon dioxide concentration" (USFWS 2003a, pp. 56-60). The 2009 FWS five year review discussed the worsening of climate change as a threat but down played the threat of urbanization and development due to the "current economic conditions" present at the time (USFWS 2009b p. 13); however, those temporary economic conditions have changed and brought on more development throughout Riverside and San Diego County, as discussed in this petition.

At the time of the original designation of critical habitat for the Quino in 2002, the FWS recognized that the Quino requires multiple occupied and unoccupied areas as well as connectivity for conservation and recovery (USFWS 2002 p. 18362):

> Areas supporting core populations (large occurrence complexes) of the Quino checkerspot butterfly, or that have the potential to support core populations (*i.e.*, areas currently containing or supporting primary constituent elements), are essential to the long term conservation of the species because they represent the foundation for continued persistence of the species. Furthermore, some habitat areas that would not be considered essential if they were geographically isolated are, in fact, essential when situated in locations where they facilitate continued landscape connectivity among surrounding local populations or otherwise play a significant role in maintaining metapopulation viability (*e.g.*, by providing sources of immigrants to recolonize adjacent habitat patches following periodic extirpation events). Populations on the periphery of the species' range, or in atypical environments, are important for maintaining the genetic diversity of the species and could be essential to evolutionary adaptation to rapidly changing climatic and environmental conditions.

The FWS has discussed the many uncertainties underlying the conservation of the Quino checkerspot butterfly but understood that "We do not yet know how much local Quino abundance, distribution, and habitat availability can be reduced without critically compromising population resiliency… losses of crucial areas within habitat patches might not be apparent until consecutive years of severe drought or high rainfall, but then have an impact disproportional to the size of the area lost" (USFWS 2009b pp. 13–14). Despite acknowledged uncertainties and need for widespread habitat conservation, FWS has permitted continued development and habitat destruction/modification even in its few remaining Core habitats.

Federal Regulations

Endangered Species Act of 1973, as amended

The federal ESA is the primary protection for the Quino through sections 7, 9, and 10. The FWS analyzes the potential effects of federal projects under section 7(a)(2) which requires federal agencies to consult with the FWS prior to authorizing, funding, or carrying out activities that may affect listed species. The FWS then determines if the action will jeopardize a species; a jeopardy determination is made for an action that is reasonably expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution; a non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a federal action (50 CFR 402.02). The FWS must also determine whether the action will result in the destruction or adverse modification of designated critical habitat.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The ESA provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a federal agency or applicant (50 CFR 402.02). For non-federal projects, the FWS may issue incidental take permits pursuant to section 10(a)(1)(B) of the ESA that are supposed to provide protection for the Quino through the approval of HCPs that "detail measures to minimize and mitigate the potential impacts of projects to the maximum extent practicable" (USFWS 2009b pp. 19–20). As described below, several HCPs that cover the Quino have been approved and, unfortunately, do not provide adequate protection for the butterfly.

Critical habitat was designated for the Quino by the FWS in 2002 but the area was subsequently reduced in 2009 as a result of a lawsuit and resulting settlement brought forth by the Homebuilders Association of Northern California and others (USFWS 2009a p. 28781). After originally designating 171,605 acres of critical habitat in four units for the Quino in 2002, the FWS reduced the designated critical habitat by 63.8% to 62,125 acres in nine disparate units based on economic, national security, and "other relevant impacts" (Figure 6 and Table 1) (USFWS 2009a pp. 28798–28799). Specifically residential development and tribal activities worth up to $50.4 million that would have occurred in the now excluded critical habitat, impacting as many as 14 developers (USFWS 2009a p. 28813). The FWS also cited their "belief" that designation of critical habitat provides a "disincentive" to entities developing or contemplating developing HCPs because "one of the incentives for undertaking conservation is greater ease of permitting where listed species are affected" (USFWS 2009a p. 28815). This belief does not take away from the fact that the Quino lost over 100,000 acres of federally protected habitat and is still threatened by development in these formally protected areas, despite the Quino's inclusion in some HCPs. In originally designating critical habitat, the FWS took into account core habitat and connectivity requirements for population viability and recovery, yet subsequently has dissected and reduced critical habitat, perpetuating the biggest threat of "death by a thousand cuts," that can lead to extinction (Whitehead et al. 2017).

When discussing the elimination of critical habitat protection on tribal land, the FWS states "we believe that fish, wildlife, and other natural resources on tribal lands are better managed under tribal authorities, policies, and programs than through Federal regulation wherever possible and practicable" (USFWS 2009a p. 28816). The FWS also continually states their strained relationship with tribes as a reason not to include their lands in critical habitat designations (USFWS 2009a pp. 28816–28821). The FWS states that the benefits of eliminating critical habitat on the Air Force land outweigh the benefits of including these lands in the name of national security (USFWS 2009a pp. 28823–28824). While these statements may be accurate, they are not a regulatory mechanism and so do not assure protection of the Quino on these lands. In addition to the loss of critical habitat, in 2009 FWS stated (USFWS 2009a p. 28):

> Although some management is occurring at a few conserved sites scattered throughout the subspecies range, no occurrence complex/population is currently being managed. Most sites are not currently managed for Quino conservation and a comprehensive assessment of the success of management practices has not been conducted…. No formal monitoring has been initiated as described, although the Service continues to qualitatively track the persistence and abundance of Quino in some occurrence complexes.

Recovery efforts for the Quino have included some habitat protection, population monitoring, and completion of a genetic study (USFWS 2009b) as well as captive breeding and reintroduction with limited initial success (Strahm 2018). The original 2003 Quino Recovery Plan predicted a drought-induced crash, which has occurred since 2012 reducing adult numbers throughout Quino's range (USFWS 2003 p. 31, 2019 p. 3). The 2003 Recovery Plan criteria included protecting all remaining habitat, but as detailed above in the "Current population" section, Quino has been lost from all occurrences in northwest Riverside, from one of the two core occurrence complexes in the Southwest Riverside Recovery Unit, and a dozen populations in western Riverside County since Recovery Plan publication (USFWS 2019 p. 3).

The 2019 Quino Recovery Plan amendment concluded correctly that Quino likely "will need assistance to reestablish or maintain population resilience across its post-listing range to achieve recovery" and that "core occurrence complexes within the species' current range must be protected, as they represent resilient populations or metapopulations that are most likely to rebound from low population numbers after drought, fire, or other stochastic events" (USFWS 2019 pp. 3, 18–19). Recovery Plan criteria include protection of 40 non-core and 15 core complexes in perpetuity, especially establishing resilient populations for metapopulation health, including the crucial for survival Skinner/Johnson, Oak Mountain, and Otay core occurrence complexes (USFWS 2019 p. 17). Unfortunately, despite this realization by FWS, they continue to do the opposite by permitting development projects that destroy Quino core populations in the only areas the butterfly remains, and in the case of Otay Village 14, trading the loss of high quality occupied habitat for unproven and likely to fail restoration attempts.

Further, section 7 consultation is supposed to result in the adoption of reasonable and prudent alternatives that avoid jeopardizing the species or destroying or adversely modifying its critical habitat, but consultation on actions that may affect Quino, typically on Clean Water Act section 404 permits, has primarily been a vehicle for authorizing the incidental take of Quino without effective measures to address habitat loss and fragmentation. Even under an HCP, the minimize and mitigate process may well produce deficient and non-compensatory mitigation. For example, determinations of how much land can be set aside on-site, the viability of alternative project designs, or how much mitigation can occur offsite are routinely based upon the applicants' own determinations of what is financially feasible for them. Self-serving applicant determinations become the basis for determining what is "practicable." The USFWS has no development economists on staff and does not retain outside consultants for the purpose of making its own determinations.

National Environmental Policy Act

The National Environmental Policy Act ("NEPA") requires the preparation of an environmental impact statement with public review and input (42 U.S.C. § 4231 et seq). NEPA requires Federal agencies to consider the effects of their actions on the environment through the utilization of environmental assessments and environmental impact statements. These reports must disclose any adverse impacts to the environment including impacts to sensitive and federally listed threatened and endangered species. However, courts have interpreted the law to only require agencies to disclose the impacts of their actions to the public, but not to prohibit agencies from choosing alternatives that will negatively affect individuals or populations of the Quino. As the U.S. Supreme Court held in *Robertson v. Methow Valley Citizens Council* (1989):

> [I]t would not have violated NEPA if the Forest Service, after complying with the Act's procedural requisites, had decided that the benefits to be derived from downhill skiing at Sandy Butte justified the issuance of a special use permit, notwithstanding the loss of 15 percent, 50 percent, or even 100 percent of the mule deer herd. Other statutes may impose substantive environmental obligations on federal agencies, but NEPA merely prohibits uninformed—rather than unwise—agency action.

National Forest Management Act

Congress enacted the National Forest Management Act of 1976 ("NFMA") to reform

Forest Service management of national forest system lands (16 U.S.C. § 1600 et seq). The NFMA requires that the Forest Service implement a Land and Resource Management Plan ("LRMP") for each national forest. The LRMP must include land allocations, desired conditions, objectives, and standards and guidelines with which site-specific projects must comply. In addition, among NFMA's substantive requirements is the duty to provide for the diversity of plant and animal communities (16 U.S.C. § 1604(g)(3)(B)).

The NFMA regulations require species viability, but do not prohibit the Forest Service from carrying out actions that harm species or their habitat, stating only that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 C.F.R. § 219.19). This regulation is inadequate for the conservation of Quino because it does not require the responsible agency to support the persistence of all species, including invertebrates. Quino critical habitat is designated in the USFS San Jacinto (San Bernardino National Forest) and Palomar Districts (Cleveland National Forest) in Riverside County (USFWS 2009a p. 28800).

Federal Land Policy and Management Act

The Federal Land Policy and Management Act (FLPMA) regulates the management of public lands administered by the BLM; specifically the "management, protection, development, and enhancement of public lands" with the intention to "…preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife…" (43 U.S.C. § 102). This Act could protect the Quino on any remaining BLM lands, but thus far has failed to protect the Quino from ORV activity in BLM properties in Wilson Valley and Oak Mountain/Vail Lake Quino Core sites in Riverside County as described above.

National Wildlife Refuge System Improvement Act of 1997

This act establishes the protection of biodiversity as the primary purpose of the National Wildlife Refuge system. Quino habitat within the Otay core complex in southern San Diego County has been conserved within the National Wildlife Refuge System (USFWS 2009a p. 19). This is an important designation but insufficient itself to ensure Quino survival and recovery.

Sikes Act

The Sikes Act (16 U.S.C. 670) Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMPs) that provide for the conservation and rehabilitation of natural resources on military lands consistent with military uses. The Navy updated its Naval Base Coronado INRMP at the La Posta Facility to incorporate all conservation measures included in the current Quino Habitat Enhancement Plan and address expansion plans for the La Posta Facility (USFWS 2009a p. 18). However, INRMPs are not regulatory mechanisms because their implementation is subject to funding availability and thus insufficient to ensure Quino survival and recovery.

The Lacey Act

The Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371, makes unlawful the import, export, or transport of any wild animals whether alive or dead taken in violation of any United States or Indian tribal law, treaty, or regulation, as well as the trade of any of these items acquired through violations of foreign law. The Lacey Act further makes unlawful the selling, receiving, acquisition or purchasing of any wild animal, alive or dead. The designation of "wild animal" includes parts, products, eggs, or offspring. This Act could protect Quino from trade or sale if enforced to do so; however, the Lacey Act cannot protect loss of Quino habitat.

Pesticide regulations

The U.S. Environmental Protection Agency (EPA) licenses the sale and use of the herbicides and insecticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA, 7 U.S.C. § 136 et seq). FIFRA directs EPA to register a pesticide only upon determining that "when used in accordance with widespread and commonly recognized practice it will not generally cause unreasonable adverse effects on the environment" (7 U.S.C § 136a(c)(5)(D)). The EPA evaluates the risk of pesticides to insects by using honey bees as a surrogate for all terrestrial insects. Butterfly physiology, behavior, and life cycle characteristics differ from honey bees in ways that are not considered when tests are applied only to honey bees (Hoang et al. 2011 pp. 997–998). For example, butterfly adults have greater surface area, including their wings, than honey bees and all stages of the butterfly life cycle are exposed to pesticides on plants, making them more likely to be exposed corporally during pesticide spray or from drift (Hoang et al. 2011; Bargar 2012). Thus, the EPA does not adequately regulate pesticides for risk to butterflies.

State Regulations

California Environmental Quality Act

The environmental review process under the CEQA (California Public Resources Code §§ 21000-21177) requires state agencies, local governments and special districts to evaluate and disclose impacts from "projects" in the state. CEQA declares that it is the policy of the state to prevent "the elimination of fish or wildlife species due to man's activities, ensure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities" (California Public Resources Code, section 21001(c)). The CEQA process is triggered when discretionary activities of state or local agencies may have a significant effect on the environment and requires full disclosure of the potential environmental impacts of proposed projects. The operative document for major projects is usually the Environmental Impact Report (EIR).

Under CEQA, Species of Special Concern must be considered during the environmental review process, with an analysis of the project impacts on the species, only if they meet the criteria of sensitivity under Section 15380 of the CEQA Guidelines. For federally listed species like the Quino checkerspot butterfly, an EIR typically indicates that the species is covered by an

HCP or that the impacts will be addressed through section 7 consultation, thus not providing adequate protection to the Quino per se.

Besides ensuring environmental protection through procedural and informational means, CEQA also has substantive mandates for environmental protection. The most important of these is the provision requiring public agencies to deny approval of a project with significant adverse effects when feasible alternatives or feasible mitigation measures can substantially lessen such effects. In practice, however, if significant impacts remain after all mitigation measures and alternatives deemed feasible by a lead agency have been adopted, a lead agency is allowed under CEQA to approve a project despite environmental impacts if it finds that social or economic factors outweigh the environmental costs. It is important to note that CEQA is not, nor was it ever intended to be, a habitat protection mechanism.

The CDFW and FWS often provide comments on draft EIRs and often, these comments are simply dismissed or responded to in immaterial ways. For example, the CDFW commented extensively on the severe deficiencies of the environmental reviews for Otay Village 14, taking issue with claims of non-occupancy and recommended additional mitigation (CDFW 2018) but no substantive changes were made in response, and deference was given to future permitting under the federal ESA.

Natural Community Conservation Program

The Natural Community Conservation Program (NCCP) is a cooperative effort supported by the CDFW and FWS to protect regional habitats and species under the Natural Community Conservation Planning Act (CDFG 2002; CDFW 2020). The program helps identify and provide for area-wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity (CDFG 2002 sec. 2801). Many Natural Community Conservation Plans are developed in conjunction with HCPs prepared pursuant to the Federal Endangered Species Act. All HCPs outlined below are also part of a NCCP (CDFG 2019).

Local Regulations

Western Riverside County MSHCP

The Western Riverside County MSHCP encompasses 1.26 million acres including all unincorporated Riverside County land west of the crest of the San Jacinto Mountains to the Orange County line and the cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Riverside, Moreno Valley, Banning, Beaumont, Calimesa, Perris, Hemet, and San Jacinto (Dudek & Associates, Inc. 2003a pp. 1–1). The MSHCP authorizes take of 146 listed and unlisted imperiled plant and wildlife species identified within the Plan Area to “provide the infrastructure necessary for economic development and a high quality of life in the County” (Dudek & Associates, Inc. 2003a pp. 1-1,4,17). The FWS issued an incidental take permit (USFWS 2004, TE-088609-0) under section 10(a)(1)(B) of the Act to 22 permittees under the MSHCP for a period of 75 years (USFWS 2009a p. 21). The Quino is a covered species.

Originally, there were 22 Quino occurrence complexes within the MSHCP Plan Area and seven core population areas; the MSHCP covers 109,161 acres of potential habitat but contains 'Conservation Areas' of 67,493 acres (27,314 hectares) of Quino habitat meant to support the seven core areas (Dudek & Associates, Inc. 2003b p. I–18, 19; USFWS 2009b p. 21). As such, the MSHCP allows for incidental take in 41,668 acres of potential habitat within Quino Core Areas, 32% of which are areas with high certainty of occupancy (Dudek & Associates, Inc. 2003b p. I–27, 28, 38). Under the MSHCP, if permitted entities alter public or quasi-public land so that it no longer contributes to the conservation strategy of the MSHCP, they must do a 1:1 mitigation on biological equivalent or superior acreage based on Quino's defined primary constituent elements; FWS views this is protective of critical habitat and its role in Quino recovery (USFWS 2011 p. 14).

In 2019, 15 years after the issuance of the take permit, the MSHCP reserve creation is ongoing and expected to take over 20 years to complete (Biological Monitoring Program 2019 p. iii). Current monitoring done to meet the MSHCP Quino-specific Conservation Objective 4 focus on six of the Core Areas identified in the Conservation Object 1: Warm Springs Creek, Johnson Ranch/Lake Skinner, Oak Mountain, Wilson Valley, Sage, and Silverado/Tule Peak as well as two non-core satellite areas, southwest San Bernardino National Forest and Cactus Valley; the Quino is not surveyed for at the Lake Mathews/Estelle Mountain/Harford Springs Core Area because it was extirpated from that area (Biological Monitoring Program 2019 p. 1).

In 2018, only 54 total adult Quino were found in only four of the Core Areas (Silverado/Tule Peak, Oak Mountain, Johnson Ranch/Lake Skinner, and Sage) and one of the non-core satellite areas (Cactus Valley) (Biological Monitoring Program 2019 pp. 7–9). Quino have not been seen at Warm Springs Creek Core Area since at least 2008 and only one individual adult has been seen at the Wilson Valley Core Area in the last seven survey years (Biological Monitoring Program 2019 p. 12). While there were four adult Quino observed at the Sage Core Area, the population sizes have been small and present only 50% of the past 11 years, the site is isolated and being encroached upon by invasive grasses, shrinking in size every year; thus without management, the Quino may be extirpated from this area (Biological Monitoring Program 2019 p. 12). Despite being the most productive site and being adjacent to the Multi-Species Reserve sentinel site, habitat quality at Johnson Ranch/Lake Skinner has been decreasing over the past decade (Biological Monitoring Program 2019 p. 12). Silverado/Tule Peak and Oak Mountain are the two best remaining Core Areas for Quino occupancy yet continue to be developed (Biological Monitoring Program 2019 p. 15).

Thus, there are several fundamental problems with how the MSHCP is functioning for the Quino:

- Populations in several Core Areas in the more western plan area intended to protect Quino may well be extinct, with little to no realistic chance of restoration, due to both biological barriers and financial limitations.
- Because the MSHCP is also a plan for the permitting of development (both urban and rural) and a major assembly mechanism is set asides through the land use process,

increased fragmentation of Core Areas is inevitable. At the time of MSCHP adoption in 2003, the effects of fragmentation on Quino populations were not as well recognized. Rural residential zoning covers virtually all private land in the more eastern Core Areas. The phenomenon of large lot development under existing zoning is poorly controllable, as single-family homes on thousands of legal lots can be built "by right" and any land preserved through rural subdivision process will be small and fragmented.

- Assembly of all Core Areas is delayed due to a structural shortfall in land acquisition funds and due to limited state and federal grants. Delay makes it more likely that sprawl development and large lot residential subdivision will intervene. The resulting incremental loss of Quino habitat and the introduction of fragmentation will destabilize viable metapopulations and increase risk of their eventual loss.
- Unpermitted recreational uses continue to degrade habitat on public lands intended to contribute to MSHCP conservation goals.

Unless these current trends change – and there is no evidence to that effect – it is increasingly unlikely that the MSHCP will be successful in conserving the Quino.

San Diego County MSCP

The San Diego County Multiple Species Conservation Plan (MSCP) is made up of the City of San Diego, portions of the unincorporated County, and 10 additional city jurisdictions, and was developed to provide for incidental take of several federally listed species in southwest San Diego County (San Diego County 2020c p. 2). The MSCP established and provided for management of 171,920 acres of preserve lands with the Multiple Habitat Preserve Area (MHPA) and Pre-Approved Mitigation Areas (PAMA), or areas where the purchase of land is approved for mitigation of lost habitat elsewhere; subarea plans were approved, including the South County Plan in 1997 (San Diego County 2020c p. 2).

Despite having one of its few major core occurrences, Otay Unit, in South County, the Quino is not a covered species under the County of San Diego (South County) subarea Plan "because not enough was known about local Quino populations at the time of plan adoption" (San Diego County 2020c p. 2). However, since 1997, more locations of Quino populations and habitat have been identified and development pressure in the South County Subarea have added to the need for what is known as the "Quino Addition" in order to provide regional conservation strategies for the butterfly (San Diego County 2020c p. 2). While the Quino Addition has been discussed and planned for since at least 2003 (San Diego County 2003), the Quino checkerspot butterfly has not yet been added to the County of San Diego Subarea MSCP as a covered species (San Diego County 2020c). The proposed Village 14-specific amendment to add the Quino is not really a means of extending the MSCP's conservation measures to the Quino so much as a means of allowing take of the Quino associated with the approved Village 14 project.

The Quino is a covered species under the City of Chula Vista Subarea Plan, a plan that requires monitoring and adaptive management of Quino habitats in a conservation easement called the 'Preserve' (City of Chula Vista 2003 pp. 4–41, 5–1; USFWS 2009a pp. 20–21). The original conservation and recovery measures put forth in the Chula Vista Subarea Plan to “provide for the long-term conservation and recovery of the species in its jurisdiction” were the following actions: 1. Preserve the area within the final critical habitat designation for the Quino; 2. Maintain connectivity along key habitat linkages within the City’s boundaries; 3. Manage the Preserve for the benefit of the Quino (along with other Covered Species); 4. Restore/enhance Quino habitat; and 5. Minimize project impacts to Quino which, taken together, they claim “provides an extraordinary net biological benefit to the species when weighed against anticipated impacts” (City of Chula Vista 2003 pp. 4–41, 4–42). The subarea plan protects and manages 2,806 acres of potential Quino habitat as part of the Preserve that extends onto lands owned by Otay Ranch, Rolling Hills Ranch, and Bella Lago (City of Chula Vista 2003 pp. 4–46, 4–47). However, the designation of the Preserve does not prohibit planned and future infrastructure projects from impacting the Quino. Rather, it declares that impacts will be avoided “to the extent practicable as determined by the City” (City of Chula Vista 2003 pp. 4–58). No development projects outside the Preserve are subject to avoidance requirements (City of Chula Vista 2003 pp. 4–59), despite being within potential Quino metapopulations and areas of important connectivity. Further, the plan states that “none of the eight locations are considered critical populations, thus, no critical populations of the [Quino] will be impacted by the Take Authorization” (City of Chula Vista 2003 pp. 4–60). These statements show a lack of recognition of the need for various types of open, non-development habitat quality and sites throughout the Quino’s range to maintain metapopulation dynamics. Both FWS and CDFW signed off on this approach, noting deference to FWS on Quino matters.

Other HCPs

The Quino is a covered species under the San Diego County Water Authority HCP permit (San Diego County Water Authority & RECON Environmental, Inc. 2010 pp. 6–6). Within the probable impact zone (PIZ), there are 997 acres of Quino’s revised designated critical habitat and seven of the 18 occurrences in San Diego in the San Miguel Habitat Management Area; in addition, there are 23,499 acres or 37.8% of the total 62,125 acres of Quino’s designated critical habitat within the covered area (San Diego County Water Authority & RECON Environmental, Inc. 2010 p. B-29, B-173). Covered activities allow for loss of Quino habitat and indirect effects, like an increase in invasive species, that, if not temporary, are required to be mitigated in a 2:1 ratio (San Diego County Water Authority & RECON Environmental, Inc. 2010 p. B-175, 176). The HCP includes a ‘Preserve Area’ that may be used as mitigation for impacts to Quino that is 127 acres of suitable habitat and 649 acres of available habitat (San Diego County Water Authority & RECON Environmental, Inc. 2010 p. B-174). The FWS believes that the agreement provides for the “conservation of the species and their habitats within the Covered Lands to the extent such species and habitat may be affected by the Covered Activities” and agrees to a “No Surprises” rule in which no measures shall be required of the Water Authority in a future ESA section 7 consultation evaluating the impacts of a Covered Activity on the designated Critical Habitat of a Covered Species unless required by law (San Diego County Water Authority & RECON Environmental, Inc. 2010 p. Agreement, 31).

The Quino checkerspot butterfly is also a covered species under a low-effect HCP held by the San Diego Gas and Electric Company (SDG&E) for anticipated take of 33 acres of Quino habitat as a result of ongoing operations and maintenance activities and construction of new facilities in San Diego, Riverside, and Orange Counties in California (Ebbin Moser & Skaggs LLP 2007 p. i). Unavoidable impacts to occupied habitat are mitigated in a 2:1 ratio and to suitable habitat in a 1:1 ratio by one or more of the following ways: payment into a Quino habitat fund managed by the San Diego Foundation, enhancement of a portion of the existing SDG&E mitigation parcel which could support Quino habitat, purchase credits from an established Quino bank should one be approved by the Service at a future date, or create a new mitigation bank (Ebbin Moser & Skaggs LLP 2007 pp. 13–15). Due to surveys and mitigation of activities in Quino habitat only occurring in "mapped areas", activities completed by SDG&E outside of but adjacent to Quino habitat known at the time of the HCP are not subject to mitigation (Busby 2014 pp. 3–5). Thus, this HCP allows for non-mitigated activities within potentially important Quino habitat due to the dynamic nature of suitable habitat and Quino metapopulations.

Captive Breeding and Reintroduction Project

A team of FWS, scientists, managers, and the San Diego Zoo are conducting a captive rearing and reintroduction project to augment the Quino population at the San Diego National Wildlife Refuge which is part of the Otay metapopulation (Strahm 2018 p. 1). Around 10 gravid females were collected from Tule Peak Road near Anza in southern Riverside County in 2016 and from McMillian Parcel in Otay in San Diego in both 2017 and 2018 (Strahm 2018 pp. 9–10). Eggs from collected females were reared and diapause larvae reintroduced to San Diego County on San Miguel Mountain in Jamul, CA and to the south near the Brown Field Municipal Airport in 2017 and 2018 (Strahm 2018 pp. 3–5). The 2017 and 2018 release years were boom and bust years, respectively, but reintroduced larvae emerged as adults in the initial and possibly in the second year (Strahm 2018 p. 32). Captive breeding and reintroduction are experimental techniques and should not be considered mitigation for loss of known occupied habitat.

Degree and Immediacy of Threats

Despite being protected as endangered by the federal ESA for 23 years, the Quino checkerspot butterfly is at greater risk of extinction today due to continued habitat loss, habitat fragmentation, climate change, invasive species, and lack of enforced protections. Tellingly, the major FWS recovery objectives for the Quino have not changed but only multiplied in the 16 years from 2003 to 2019 (USFWS 2003 pp. 92–95, 2019 pp. 17–19). Besides the lack of knowledge on Quino's natural history and progress on captive rearing and release, threats to the butterfly have only been exacerbated and recovery objectives have not been met. Specifically, occurrence complexes, critical habitat, and habitat connectivity have not been permanently protected or adequately managed, restored, or enhanced to maintain resilient populations; resilience as defined by the drop and subsequent increase in population of equal or greater magnitude has not occurred and the Quino has been extirpated where the FWS required additional populations (e.g. Lake Matthews and Northwest Riverside Recovery Unit) (USFWS 2003 pp. 92–95). The Quino checkerspot butterfly has been eliminated from over half of its historical range in Southern California, and Quino have only been observed in ~53% of identified extant sites in Riverside (12/28) and San Diego (21/34) Counties since 2010 (USFWS 2019). Continued land-use planning that allows for development within core critical habitat and the lack of adequate management continues to push this butterfly to the brink of extinction.

The 2019 amendment to the Recovery Plan includes criteria that address key Quino threats from nonnative plants, enhanced nitrogen deposition effects, increasing atmospheric carbon dioxide effects, from off-road vehicle activity and grazing, and the risk of permanent population extirpation due to wildfire and climate change (USFWS 2019 p. 18). These threats have been impacting the butterfly since federal listing and are included in the original Recovery Plan (USFWS 2003 pp. 178–179) and the butterfly will have no chance to persist if its habitat is destroyed and fragmented through continued development with little regard of its metapopulation and connectivity needs, including preservation of unoccupied patches. Currently there are at least six major development projects in the Quino's few remaining Core population areas that are slated to begin imminently or within the next few years, as outlined above. By first decreasing the Quino's designated critical habitat and then allowing large scale development projects and the construction of the border wall within its few remaining strongholds, FWS has failed to protect the Quino checkerspot butterfly, making it in dire need of increased protections as endangered under the CESA. As described above, in projects that pose major threats to Quino core populations, like Otay Village 13 and 14, CDFW currently plays a minor role on Quino issues, deferring to the FWS as the only regulatory authority regarding the butterfly. Without state protections, California could lose Quino checkerspot butterflies permanently.

Suggestions for Future Management and Recovery Actions

Management actions in California can address threats to the Quino checkerspot butterfly including but not limited to habitat loss, reduced connectivity, nitrogen deposition, increased wildfire frequency, invasive species, off-road vehicles, poorly managed grazing, and climate change. All these threats can and should be addressed at the State level. Listing under the CESA will fundamentally change how much conservation occurs in the future and how likely it will be that the Quino will survive. Unlike the provisions of federal law described above, which have afforded the Quino little or even no mitigation and conservation benefit, a permit for take of a listed species under CESA requires a *specific standard* for mitigation: "measures to minimize and *fully mitigate* the impacts" (emphasis added). If the Quino is to survive and recover from its current severe depletion and other challenges, fully compensatory mitigation is a bare minimum necessity. The federal standards and practices have failed and there is no indication that they will be applied to reverse the Quino's decline. Recommendations for the management and recovery of the Quino include, at a minimum:

- CDFW should protect the Quino checkerspot butterfly as endangered under the CESA and prepare a recovery plan pursuant to Cal. Fish & Game Code § 2079.1, including management efforts aimed at reducing habitat loss and degradation.
- Acquire and protect areas with suitable habitat that promote connectivity within and between metapopulation complexes. In particular, permanent protection for core occurrence complexes with known populations of Quino and its host plants is desperately needed, as those areas support the requisite clay soil with cryptobiotic crust that supports the host plant growth form and seasonality required by the Quino (Osborne 2019). Source populations that are resilient to events such as drought are top priority.
- Protect habitat and connectivity at extirpated Quino occurrence complexes, including the northwest Riverside Recovery Unit and the Warm Springs Creek Core complex (southwest Riverside) for possible though as yet experimental Quino reintroduction.
- Continue currently experimental efforts to restore/enhance degraded habitat, including remediation of elevated artificially elevated soil nitrogen. Continue experimental Quino reintroduction efforts. Such efforts should *not* be considered as a substitute or mitigation measure for protection of high-quality existing habitat.
- Ensure Quino habitat is buffered from nitrogen pollution and that off-road vehicle rules are enforced, especially in and around the Oak Mountain core population.
- Protect habitat with any or all known and potential host plants listed in this petition, not just *P. erecta*, but also lesser known potential hosts such as *Antirrhinum nuttallianum*. Care should be taken to use the annual variety adapted to clay lenses and not the short-lived perennial adapted to granitic soils (Pratt 2020a).
- For climate change adaptation, acquire and protect higher elevation habitats such as near Tule Peak and Bautista Road and their connections to other habitat areas. Prioritize the conservation of known Quino populations near water bodies. The remaining largest and most resilient Quino populations are associated with water bodies, particularly large and long-established reservoirs such as Lake Skinner, Vail Lake, and Lower Otay Lake, most likely due to the available moisture during times of drought (USFWS 2019 p. 4). Due to the reduction of cooler, high humidity coastal habitat due to development, it is essential that metapopulations near water bodies are conserved as they will likely contribute to Quino's resilience to climate change (USFWS 2019 p. 4).

Conclusion

In this petition, we have carefully assessed the best scientific and commercial information available regarding the Quino checkerspot butterfly. We have reviewed the best scientific and commercial information available regarding the historic, present, and future threats faced by the Quino and have determined that the butterfly is in imminent danger of extinction throughout its range, largely due to sprawl development projects in its few remaining Core population areas. The protection afforded to the Quino under the federal ESA has not proven to be effective at reducing its risk of extinction, which has only exacerbated over recent years. In the United States, the Quino checkerspot butterfly is endemic to California and despite its suffering under threats unique to California's economic growth and development, it does not currently receive California-specific protection. As such, we urge the California Fish and Game Commission to protect the Quino checkerspot butterfly as endangered under the California Endangered Species Act.

Please contact me at 503-283-5474 and/or tcornelisse@biologicaldiversity.org if you have any questions or need any clarification on the above information.

Sincerely,

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